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Sierra 418A-1

PCM ERROR PERFORMANCE ANALYZER

MAINTENANCE MANUAL

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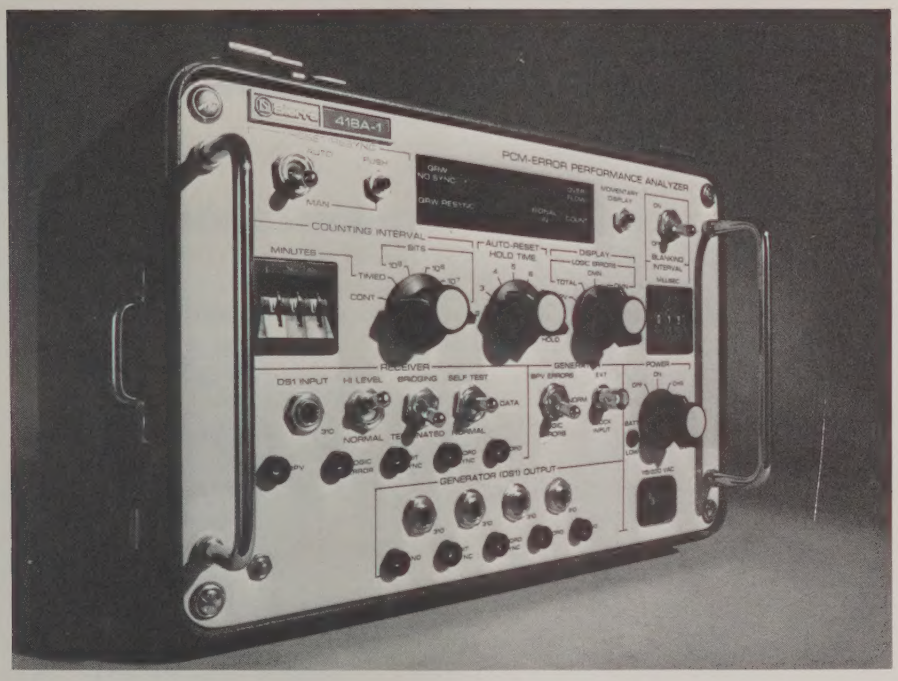

LSI/Sierra 418A-1 PCM Error Performance Analyzer

This Maintenance Manual provides information for service and calibration center use. It is suggested that the instrument be calibrated on an annual basis, depending upon conditions and user requirements.

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1. FUNCTIONAL DESCRIPTION

1.01 The Sierra 418A-1 consists of four main sections: a generator, a receiver, a counter/display, and a power supply. Refer to Figures 1-1 and 1-2.

GENERATOR

1.02 The basic test signal generated by the 418A-1 is standard Quasi-Random Word (QRW). It is a repetitive sequence of 1,048,575 bits produced at a rate of 1.544 megabits per second. Each QRW is therefore 679 milliseconds in length. A 20-bit shift register and special gate circuits provide the "$2^{20}-1$" bit count. QRW simulates an active PCM terminal by producing a similar spectrum of energy. The signal is limited to a maximum of 14 digital zeros in sequence, to correspond with current practice. Good repeaters can generally tolerate 14 zeros (no pulses) in sequence, while marginal repeaters may fail because their resonant input circuit tends to fall out of step during lengthy absence of pulses.

1.03 Four separate signal outputs permit loading up all or any part of a T1, T1C, T148, T2 or any other T1-based multiplex system. The signals may also be used to keep spare lines or new lines active until needed. The QRW is valuable for crosstalk testing, since the signal pattern accurately simulates actual T1 carrier energy density found in working lines.

1.04 Two types of errors may be intentionally inserted into the 418A-1 test signal: Bipolar Violations and Logic Errors. (A Bipolar Violation occurs when the line signal contains two consecutive pulses of the *same* polarity, which violates the normal alternating pulse pattern. Logic Errors refer to improper data bits in the Quasi-Random Word itself.)

1.05 Bipolar Violations may be inserted at a rate of eight (8) BPV per each QRW word (approximately every 2/3 second). Logic Errors may be inserted at a rate of (15) total errors for QRW word. Eight of the 15 are *"errors of commission"* (extra bits); seven are *"errors of omission"* (missing bits).

1.06 Generator test points are provided on the front panel for WORD, WORD SYNC, BIT SYNC, and GND. External test equipment such as an oscilloscope, etc. may be connected if desired.

RECEIVER

1.07 The receiver section has a DS1* INPUT (310-type) jack for connection to the circuit under test. A built-in ALBO repeater accommodates various input signal levels. In addition, a HI LEVEL/NORMAL toggle switch adapts the input for high level signals (6 volts peak-to-peak ±0.3 volt) such as may be encountered directly out of a repeater or monitor jack. The BRIDGING/TERMINATED switch selects either a terminating impedance of 100 ohms or a bridging impedance of more than 1000 ohms (at a loss of 0.25 dB or less).

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*DS1 means Digital Signal of the 1st Level. This has become common language for T1 signals at 1.544 Mb/s.

Figure 1-1. Basic Sections

1.08 A third receiver switch selects the mode of operation: NORMAL, NO DATA, or SELF TEST. In the NORMAL position the 418A-1 analyzes the signal connected to the DS1 INPUT jack. In the NO DATA position the received signal can be interrupted for checking purposes. (The SIGNAL IN and COUNT indicators will then extinguish and the QRW NO SYNC indicator will light.) When the switch is placed in the SELF TEST position, the 418A-1 generator output is internally connected to the receiver for checking purposes. Since the generator signal can be made to contain a known quantity of errors, the receiving, counting and display functions (as well as the generator) can be quickly and easily tested by the operator.

1.09 Bit synchronization is recovered from the incoming signal. It is used to synchronize the received data and to clock the receiver QRW generator. The receiver QRW is compared bit-by-bit to the incoming QRW signal. Errors are detected and counted. Loss of synchronization occurs if more than 30% of the incoming bits are in error, which is shown by the QRW NO SYNC indicator.

1.10 In the Manual (MAN) position of the RESET/RESYNC control, loss of synchronization causes the QRW NO SYNC lamp to light until manually reset. Resetting is accomplished by depressing the button marked PUSH. The QRW NO SYNC lamp will extinguish if proper signals are being received.

1.11 In the automatic (AUTO) position of the RESET/RESYNC control, loss of synchronization causes the QRW NO SYNC lamp to light *during the period of loss.* If synchronization is restored, the QRW NO SYNC lamp will extinguish and the QRW RESYNC will light to alert the operator that synchronization was lost at some time during the test.

1.12 The AUTO resync feature is usually employed with the COUNTING INTERVAL switch in one of the BITS positions (10^9, 10^8, 10^7, or 10^6). The QRW RESYNC lamp can be extinguished by depressing the "PUSH" button.

NOTE: During tests on an active T1 line signal where NO QRW IS PRESENT, it will be normal for RESYNC and NO SYNC lamps to be lighted. Disregard during this type of testing.

1.13 If the operator finds the QRW RESYNC lamp lighted during a test, he may wish to disregard the error count and restart a new test interval.

1.14 Bipolar violations are counted by separate circuitry (see Figure 3-2, Functional Block Diagram). The signal flows through the ALBO repeater and the unipolar converter to the BPV detector.

1.15 Front panel test points for the Receiver include BPV, LOGIC ERROR, BIT SYNC, WORD SYNC and WORD. An extra Ground jack is provided.

COUNTER/DISPLAY

1.16 The 418A-1 features highly accurate electronic counting and digital display. Bright 3-digit LED numerals can be read at a distance. Two counting circuits are included so that BPV can be stored while counting and displaying logic errors. For logic errors the display can be switched to show total logic errors, errors of commission (extra data bits), or errors of omission (missing data bits).

1.17 **Counting Interval.** Five count (test) intervals can be selected. Four of these intervals are 10^6, 10^7, 10^8, and 10^9 bits.* The fifth count interval is a timed interval controlled by an electronic timer with a range of 0 to 199 minutes. Accuracy is ±0.5% of the selected time. Unrestricted continuous counting is also available.

1.18 **Blanking Interval.** Blanking interval controls are provided to prevent counting of errors for a preselected time after an error has been counted. The blanking interval feature has an on-off switch and a thumbwheel digital selector adjustable over a range of 0 to 999 milliseconds with an accuracy of ±1 millisecond. Typical uses of the Blanking Interval feature are discussed in the operation manual.

1.19 **Display Controls.** The test set counts and displays 0 to 999 errors and provides an overflow indication for error counts in excess of 999. During the count interval the 3-digit LED display reads out the selected error count as it is accumulated. An AUTO-RESET HOLD TIME control is provided which is activated only when the RESET/RESYNC toggle switch is in

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* Although exact powers of 10 are shown on the switch (according to general practice) a QRW word is not terminated at the end of the exact power of 10. It is allowed to continue to completion. For example, 10^6 (1,000,000) is actually 1,048,575 (1 QRW word). 10^7 is a full 10 words; 10^8 is 100 words; 10^9 is 1000 words.

the Automatic (AUTO) position. The AUTO-RESET HOLD TIME control selects the amount of time the display is held after the counting interval has been completed.. The display interval can be adjusted over a range of 2 to 20 words (approximately 1.4 seconds to 14 seconds). At the end of the selected display period the counter and display will automatically dump the stored information and begin another count. If, however, the AUTO-RESET HOLD TIME control is set to HOLD, the display and counter will be "frozen" until the operator presses the RESET/ RESYNC "PUSH" button to start another counting/display cycle. (The display is also "frozen" if the RESET/RESYNC toggle switch is in MAN position, or if the TIMED count interval is selected.)

1.20 The DISPLAY selector can be switched to show BPV (bipolar violations); LOGIC ERRORS-TOTAL, LOGIC ERRORS-CMN (commission; extra bits); or LOGIC ERRORS-OMN (omission; missing bits). The 418A-1 contains a dual Counting Memory. Both BPV and Logic Errors can be counted at the same time *subject to special limitations* described in the operation manual. A REMOTE OUTPUT position is also provided. It is associated with a special connector, described in the next paragraph.

1.21 Other lamps on the display panel (not previously mentioned) are the SIGNAL IN indicator and the COUNT indicator. SIGNAL IN will light in the presence of a signal at the DS1 INPUT jack. The COUNT indicator lights when a counting interval is in progress.

1.22 In order to extend battery life when the test set is on battery power, the LED display *does not light* during the count interval. It comes on during the display interval after the count has been completed and at *half* the normal brilliance. If the operator wishes to see the display during counting, he may push the MOMENTARY DISPLAY button. Also, this button will change the half brilliant display to full brilliance.

POWER SUPPLY

1.23 The 418A-1 may be operated from 115/230 volt ac power or from internal rechargeable batteries. The instrument switches to battery power automatically when the ac power cord is disconnected. The POWER switch has OFF, ON and CHG (charge) positions. Two indicator lamps are provided. CHG lights only when the set is in the battery charge mode. BATT LOW is a sensitive monitor during battery operation. It will flash on and off to warn when there are only 20 to 40 minutes of battery charge remaining. When battery power becomes too low for proper operation, the test set is automatically cut off and the indicator will light steadily. The instrument is immediately re-usable on ac power.

1.24 Normal battery complement is 15 rechargeable NICKEL-CADMIUM batteries which, when fully charged, give an average use of 5 to 6 hours, Batteries can be fully recharged in 14 hours.

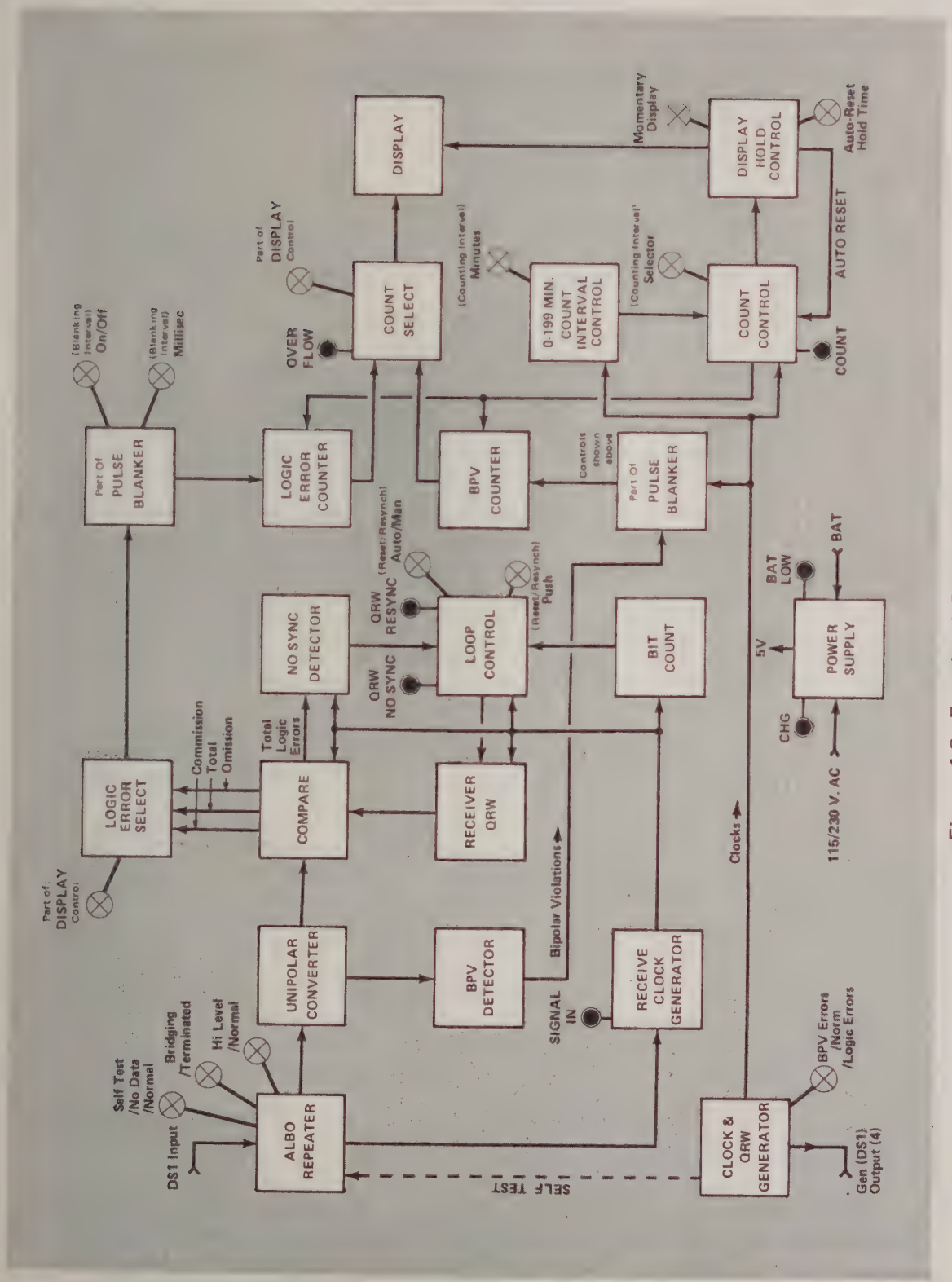


Figure 1-2. Functional Block Diagram

2. CALIBRATION

TEST EQUIPMENT

2.01 Test equipment recommended for maintenance of the Sierra 418A-1 is listed in Table 2-1. Equivalent instruments with characteristics equal to or better than those listed, may be used in lieu of specific models or types recommended.

Table 2-1. Test Equipment

ITEM	QTY RQD	MANUFACTURER	MODEL OR PART DESIG	COMMENT
Digital Multimeter (DMM)	2	Fluke	8000A	
Variable DC Power Supply	1	Power Design	2015	0-12V, 1-5A minimum
Frequency Timer/ Counter	1	Fluke	1952B	80 MHz Frequency range.
Oscilloscope	1	Tektronix	7603	Dual trace A&B function, 50 MHz bandwidth or greater, x10 probes.
Dual Trace Amplifier	1	Tektronix	7A18	
Time Base	1	Tektronix	7B50A	
Patch Cord	2	Sierra	916400037	With 310 to 310 plugs

INTERNAL ACCESS

2.02 For access to internal parts of the 418A-1 and to various test points on PCB.s, remove the instrument from its metal case as follows:

Step 1: Remove case carrying cover and verify POWER switch is in OFF position. If AC power cord connected, disconnect.

Step 2: Loosen four quick-connect screws on front panel.

Step 3: Carefully lift test set from case until partially removed.

Step 4: Disconnect battery cable and continue to lift until instrument clears case.

POWER SUPPLY

2.03 To perform power supply calibration, proceed as follows: (Refer to Figure 2-1.)

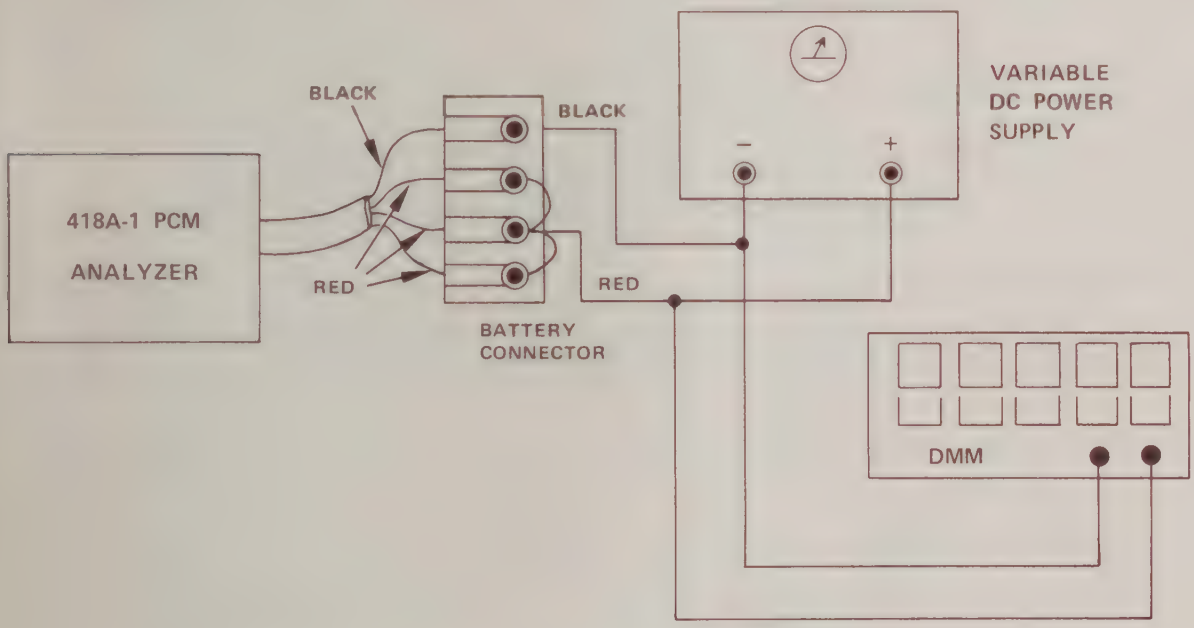


Figure 2-1. Unit Under Test Configuration

Step 1: Interconnect 418A-1 Unit Under Test (UUT) to variable DC power supply and DMM test equipment as illustrated in Figure 2-1.

Step 2: Set DC power supply so DMM indicates 6.3 volts.

Step 3: Set 418A-1 POWER OFF/ON/CHG selector control switch to ON and allow all instruments to warm up for 15 minutes.

Step 4: Set DC power supply so DMM indicates 6.0 volts.

Step 5: Adjust potentiometer R26 on A7 PC board so 418A-1 front panel BATT Low indicator flashes.

Step 6: Set DC power supply so DMM indicates 6.3 volts. Verify that 418A-1 BATT Low indicator extinguishes.

Step 7: Decrease DC power supply level until BATT Low indicator flashes, and verify that DMM indicates between 5.8 and 5.86 volts when first flash appears.

Step 8: Set voltage reading on DMM to 5.6 volts, and verify that 418A-1 BATT Low indicator illuminates in steady state while front panel display unit remains extinguished.

Step 9: Adjust power supply so DMM indicates 6.5 volts, and verify that 418A-1 BATT Low indicator extinguishes.

Step 10: Disconnect DC power supply from 418A-1 and connect AC power cord into 418A-1 UUT.

Five-Volt Level Adjustment

Step 11: Connect DMM to junction of L1/R19 and chassis GND on A7 PC board.

Step 12: Adjust potentiometer R13 on A7 PC board for 5.1 volts indication on DMM.

Generator Output Verification

Step 13: Connect 310 plug with 100-ohm termination to 418A-1 GENERATOR (DS1) OUTPUT jack and connect oscilloscope channels 1 and 2 as shown in Figure 2-2.

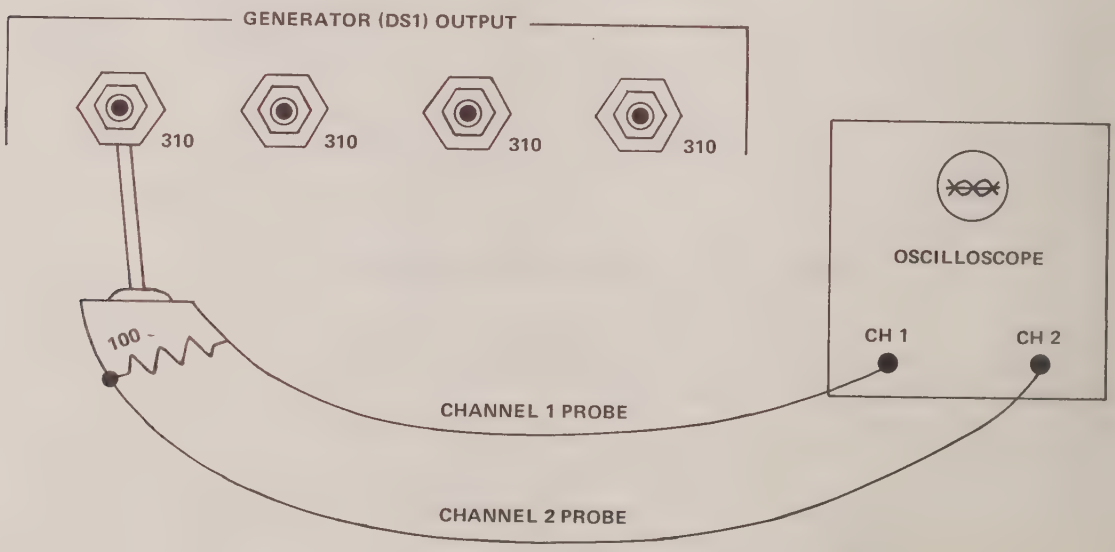


Figure 2-2. Oscilloscope Connection to 418A-1 Analyzer

Scope Settings

Step 14: Using x10 probes, set scope channel 1 and channel 2 both on 0.1V/DIV with channel 2 inverted.

Step 15: Set scope in ADD mode (differential) and triggering on any channel.

Step 16: Verify that pulses of QUASI RANDOM SIGNAL are 6.0 ±0.6 volts peak-to-peak.

Step 17: Remove 310 plug with 100-ohm termination from GENERATOR (DS1) OUTPUT jack of 418A-1.

ALBO

2.04 Perform ALBO adjustments as follows:

Step 1: Set 418A-1 controls as listed in (a) through (i).

a. RESET/RESYNC toggle switch to AUTO.
b. COUNTING INTERVAL selector switch to 10^6.
c. AUTO-RESET/HOLD TIME selector switch to 1.
d. DISPLAY LOGIC ERRORS selector switch to BPV.
e. BLANKING INTERVAL toggle switch to OFF.
f. HI LEVEL/NORMAL toggle switch to NORMAL.
g. BRIDGING/TERMINATED toggle switch to TERMINATED.
h. SELF TEST/NORMAL/NO DATA toggle switch to SELF TEST.
i. BPV ERRORS/NORM/LOGIC ERRORS toggle switch to BPV.

Step 2: Set scope vertical inputs for 0.1 V/Cm on both channels with mode set to alternate sweep. Set scope sweep controls to 0.2 µS/Cm internal trigger.

Step 3: Connect scope channel 2 probe to junction connecting R24 and R25 (base of Q6) on A1 PC board.

Step 4: Connect scope channel 1 probe to left hand end of L3 (collector of Q8) on A1 PC board.

Step 5: Verify display indicates "008".

Step 6: Should display show errors, adjust variable transformer T2 of A1 PC board so pulses occur in center of eye as shown in Figure 2-3. (Set trailing edge of channel 1 pattern to center of eye.)

Step 7: Remove scope connections from 418A-1 Analyzer.

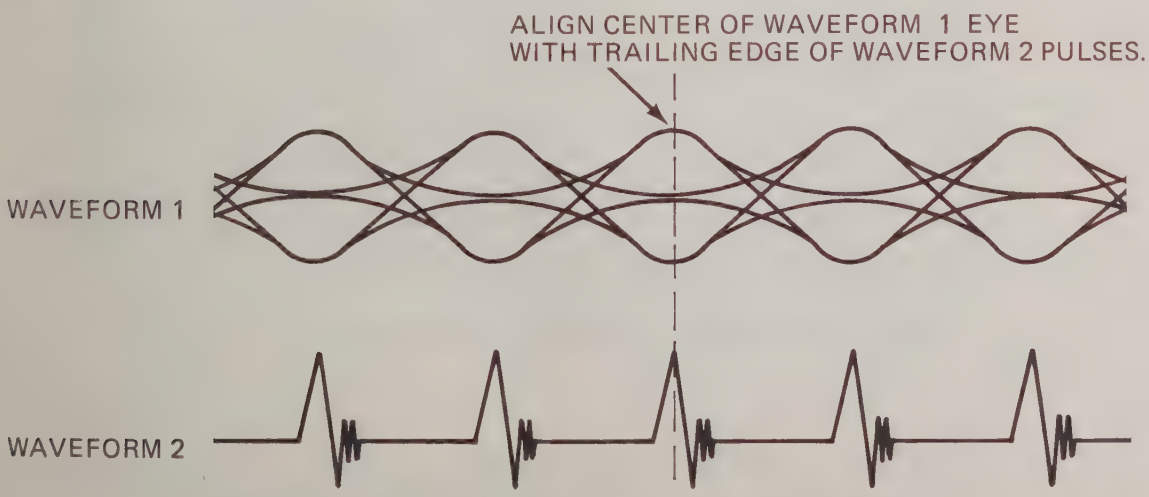


Figure 2-3. Pulse Amplitude and Center of Eye Correlation

CLOCK PHASE

2.05 To perform clock phase adjustments, proceed as follows:

Step 1: Set scope vertical inputs for 0.5 V/Div on both channels with mode set to alternate. Set sweep controls to 0.5 uS/Div, trigger peak-to-peak auto, internal, positive DC.

Step 2: Connect CHAN 1 test probe to TP2 on A2 PC board and CHAN 2 test probe to TP1 on A2 PC board. Trigger on CHAN 1.

Step 3: Referring to Figure 2-2, adjust potentiometer R14 on A3 PC board (A3R14) for scope display. The rise time of signal on channel 1 should be located approximately in the center of the pulse on channel 2. (See Figure 2-4.)

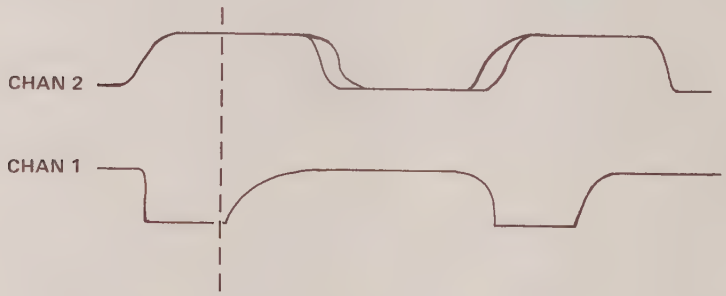


Figure 2-4. Potentiometer A3R14 Adjusted Display

CALIBRATION VERIFICATION

2.06 To insure that the test set is working correctly, it is suggested that the following operational test be performed. If results deviate significantly from anticipated results, servicing may be necessary.

2.07 In the following procedures specific controls and indicators will be pointed out. Any control *not* mentioned can remain in its present setting, since it has no effect on the feature under test.

2.08 **Power Test**

Step 1: Connect power cord if ac power to be used. (Disregard if battery power to be used.)

Step 2: Turn POWER switch to ON.

Step 3: Observe BATT LOW lamp if using battery power. Flashing or steady lamp indicates batteries are weak, i.e., below operating level. Do not continue with tests until batteries are recharged.

Step 4: Tests can be made prior to recharging batteries, if desired, by connecting the ac cord to source of power.

Step 5: Recharge is accomplished by turning POWER switch to CHG. If the ac cord is connected to a power source, the CHG ON lamp should light.

2.09 **Initial Setup (refer to Figure 2-5)**

Step 1: Position SELF TEST/NO DATA/NORMAL toggle switch to SELF TEST. (The generator is now connected internally to the receiver display. The switch will remain in SELF TEST for most of the following tests.)

Step 2: RESET/RESYNC toggle switch to AUTO. (The 418A-1 will now automatically reset its counter display at the end of each test and begin again, so that a series of identical tests can be observed.)

Step 3: AUTO-RESET HOLD TIME TO "1". (Sets readout holding time to minimun approximately 1.4 second. Readout is then dumped and a new count begins. Position "1" provides for rapid re-count. If operator desires, holding time can be increased by moving control to "2" or higher. "Hold" position causes readout to be permanently displayed.)

Figure 2-5. Faceplate

Step 4: BLANKING INTERVAL toggle switch to OFF (disables the blanking interval feature to permit receiver input circuit to count and display each error that arrives).

2.10 Bipolar Violation Self Test

Step 1: GENERATOR toggle switch to BPV ERRORS. (Generator is now inserting 8 bipolar violations per each quasi-random word, i.e., 8 errors every 679 milliseconds, approximately 2/3 second).

Step 2: DISPLAY control to BPV. (Display is now conditioned to readout bipolar violations.)

Step 3: COUNTING INTERVAL control to bits 10^6. (The counter is now conditioned to count 10^6 bits and cut off. It will then dump its count at the end of the Display Interval and start again. Actual count is 1 QRW word, or 1,048,575 bits.)

Step 4: READOUT should count to 8 and stop. Shortly thereafter it should reset to zero and count to 8 again, etc. (The generator's "word" length is 1.048 megabits in length.)

Step 5: During this test the SIGNAL IN lamp should light continuously to indicate signals are arriving constantly at the Receiver input. The COUNT lamp will light for 679 milliseconds (approximately 2/3 second) each time the count is repeated. Just before the COUNT lamp lights, the digital readout display should revert to zero. The OVERFLOW lamp should be extinguished because the readout count ends at 8 and dumps. QRW NO SYNC lamp should be extinguished because good signals are arriving without interruption. If the QRW RESYNC lamp is lighted it may have been activated by the POWER switch or the SELF TEST/NO DATA/NORMAL switch. (Depress the RESET/RESYNC "PUSH" button to extinguish the QRW RESYNC lamp.)

2.11 Logic Error Self Test

Step 1: GENERATOR toggle switch to LOGIC ERRORS. (Generator now inserts a total of 15 "logic" errors into the quasi-random word. Eight are "errors of commission," i.e., additional "1" data bits; 7 are "errors of omission", i.e., missing "1" data bits.) These errors affect only the QRW word. There are no bipolar violations generated.

Step 2: DISPLAY control to LOGIC ERRORS–TOTAL. (Receiver is now conditioned to *compare* the "incoming" QRW word with its own interval QRW word, bit-for-bit. Any incorrect bit will be displayed as an error.)

Step 3: Display should count to 15 and stop, each 679 milliseconds (one QRW word length). After a brief pause, the display should dump and start again. Indicator lamps should light as described in paragraph 5.15 step 3, above.

Step 4: DISPLAY control to "CMN" (Errors of Commission). (The Receiver now counts only added "1" bits.)

Step 5: Display should count to 8 and recycle.

Step 6: DISPLAY control to "OMN" (Errors of Omission). (Counts missing "1" bits.)

Step 7: Display should count to 7 and recycle.

2.12 Blanking Interval Self Test

Step 1: BLANKING INTERVAL toggle switch to ON. (Receiver is conditioned to blank itself, after counting an error, for a period in milliseconds determined by the thumbwheel setting. Will not count any additional errors until the blanking period is complete.)

Step 2: BLANKING INTERVAL MILLISEC thumbswitch to 679. (This is the exact length of the Quasi-Random Word, in milliseconds.)

Step 3: Display should show "1" and recycle. (The first error is counted: thereafter 679 milliseconds must occur before another count is permitted. By that time a new QRW word is being generated.)

Step 4: BLANKING INTERVAL to OFF.

2.13 Timed Counting Self Test

Step 1: GENERATOR toggle switch to BPV ERRORS. (Conditions generator to insert 8 bipolar violations per QRW word).

Step 2: DISPLAY control to BPV. (Conditions display to readout bipolar violations.)

Step 3: COUNTING INTERVAL control to TIMED. (Places counting time under control of the minutes thumbwheel).

Step 4: COUNTING INTERVAL MINUTES thumbwheel to 1 minute (reads: 001). (Permits count for one full minute before cut off).

Step 5: RESET/RESYNC toggle switch to MAN. (Generally only one cycle of counting is desired when a long period is involved, i.e., 1 to 199 minutes.)

Step 6: Depress RESET/RESYNC "PUSH" button and release. (Begins 1 minute count of bipolar violations.)

Step 7: Display should show 706 ±2. (There are 706 bipolar violations in the QRW word in a one minute time period.)

2.14 No-Data Self Test

Step 1: Observe that SIGNAL IN lamp is lighted. (indicates signals are arriving at the receiver; in this case from its generator.)

Step 2: SELF TEST/NO DATA/NORMAL toggle switch to NO DATA. (Signals are removed from the receiver input.)

Step 3: SIGNAL IN lamp should extinguish. (QRW NO SYNC lamp should light to show that synchronization has been lost.)

Step 4: SELF TEST/NO DATA/NORMAL switch to NORMAL. (418A-1 is now ready to test PCM circuits. The QRW NO SYNC lamp remains lighted from the previous test, because signals must now be applied to the RECEIVER DS1 INPUT jack.)

3. TECHNICAL DATA

SPECIFICATIONS

3.01 Specifications are listed in Table 3-1.

Table 3-1. Specifications

PARAMETER	CHARACTERISTICS
Generator Output	
Description:	Bipolar signal, balanced to ground
Amplitude:	±3 volts, ±0.3V tolerance
Bit Rate:	1.544 Mb/s
Pulse Width:	324 ±30 nanoseconds at half amplitude
Rise and Fall Times:	80 nanoseconds maximum
Trailing Edge Overshoot:	10 to 30% of pulse height with decay to 10% or less of base line-to-peak value within 400 nanoseconds
Unbalance in Height:	±0.15V between the negative and positive pulses
Unbalance in Width:	±15 nanoseconds between positive and negative pulses
Impedance:	100 ohms
Protection:	300V dc and spikes up to 500V
Transmitter Clock	
Frequency:	1.544 MHz ±50 Hz
Receiver Input	
Description:	Bipolar signal, balanced to ground
Amplitude:	100 millivolts to 6.3 volts peak-to-peak (36 db range)
Bit Rate:	1.544 Mb/s
Phase Jitter:	Maximum slope or jitter equal to ±2.5 kHz frequency offset from 1.544 MHz
Terminating Impedance:	100 ohms
Bridging Impedance:	High impedance, to allow ⩽ 0.25 dB bridging loss
High Level/Normal:	Toggle switch: will permit the insertion of high input level signal (–4 db below Reference, and above into the 418A-1 receiver input
Front Panel Test Points	
Generator	
Bit Sync:	Monitors generator 1.544 Mb/s clock signal
Word	Monitors generator 1,048,575 bit QRW
Word Sync	Monitors the generator QRW sync signal
Ground	Chassis ground (2)

Table 3-1. Specifications (Continued)

PARAMETER	CHARACTERISTICS
Receiver	
BPV	Monitors gated input to the error counting circuit for bipolar violations
Logic Error	Monitors selected gated input to the error counting circuit for logic errors
Bit Sync	Monitors receiver regenerated 1.544 Mb/s clock signal
Word	Monitors the 1,048,575 bit QRW received at the input
Word Sync	Monitors the receiver QRW sync signal
General Test Point Data	
Description	Return to zero
Amplitude	Logic Levels: $Vo_1 \leq 1V$; $Vo_2 \geq 3V$
Frequency	As shown above for individual test points
Pulse Width	324 ±30 nanoseconds at half amplitude
Rise Time	80 nanoseconds maximum
Source Impedance	Less than 100 ohms
Protection	Short circuit, any combination, including grounding
Power	
Operates from AC Power or Built-In Rechargeable Batteries (Nickel-Cadmium)	115/230V ac ±10% at 47 to 63 Hz. Front panel indicator flashes when 20 to 40 minutes of battery life remains. Remains on when batteries are below low voltage cutoff point. Immediately operable when plugged in to ac power.
Battery Life	5 to 6 hours
Recharge Time	14 hours from minimum operating level
General	
Dimensions	
Height	7-1/2 inches (19 cm)
Width	12 inches (30.5 cm)
Depth	8-1/8 inches (20.6 cm) behind front panel 12 inches (30.5 cm) with front cover attached
Weight	22 lbs. 2 oz. (10 kg) complete with batteries and cover

Table 3-1. Specifications (Continued)

PARAMETER	CHARACTERISTICS
Environment:	
Operating Temperature	0°C to +50°C external ambient without sun loading
Operating Humidity	95% maximum
Storage	–40°C to +60°C temperature at 95% maximum humidity
External Clock Input	Accepts TTL compatible clock signal from 1000 ohm source impedance $Vin_1 \leqslant -1V$ $Vin_2 \geqslant -3V$
Note: $\leqslant$ = equal to or less than $\geqslant$ = equal to or greater than	

ORDERING INFORMATION

3.02 The 418A-1 is supplied with a cloth web shoulder strap and a removable AC power/adapter cord. Additional accessories are listed in Table 3-2.

Table 3-2. Accessories

DESCRIPTION	SIERRA PART NUMBER	MANUFACTURER PART NUMBER
Rechargeable Battery (Optional) Ni-Cad (15 required)	918500005	Gould No. 4.0 SC-HI-C or G.E No. XGEW 3.5 ST HI HAT
Canvas Carrying Case	921000075	

4. SCHEMATICS AND PARTS LISTS

4.01 Following is a list of 418A-1 schematic diagrams and parts lists included in this section.

Figure Number	Description
9-1	Block Diagram
9-2	Interconnect Diagram (4 sheets)
9-3	A1 ALBO
9-4	A2 Receiver Power Generator
9-5	A3 Receiver Logic and Loop Control
9-6	A4 Error Counter (2 sheets)
9-7	A5 Time Base and Divider
9-8	A6 Generator
9-9	A7 Power Supply
9-10	A9 Display
9-11	A10/A50 Control (4 sheets)
D03092100	Power Panel Assembly
D03205100	Front Panel Assembly

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
A1	PWB ASSY, A1, 418A-1	D03165800
C1	CAPACITOR,DIPPED MICA 15PF 5% 500V	901900150
C2	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C3	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C4	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C5	CAPACITOR,DURA MICA 680PF 2% 300V	901910681
C6	CAPACITOR,DIPPED MICA 1000PF 5% 500V	901910102
C7	CAPACITOR,MYLAR .047MF 10% 50V	901100473
C8	CAPACITOR,POLYCARB .015MF 2% 50/100V	903100153
C9	CAPACITOR DIPPED MICA 100PF,5%,500V	901900101
C10	CAPACITOR,MYLAR .047MF 10% 50V	901100473
C11	CAPACITOR,TANTALUM 1.0MF 50V	902760105
C12	CAPACITOR,DIPPED MICA 10PF 5% 500V	901950100
C13	CAPACITOR,MICA 110PF,2%,500VDCW	901900111
C14	CAPACITOR,CERAMIC 100PF 2% 100V	901420101
C15	CAPACITOR,CERAMIC .01MF 10% 200V	901330103
C16	CAPACITOR,CERAMIC .01MF 10% 200V	901330103
C17	CAPACITOR DURA MICA 27PF 2% 500V	901910270
C18	CAPACITOR,DIPPED MICA 1000PF 5% 100V	901920102
C19	CAPACITOR,DIPPED MICA 75PF 5% 500V	901900750
C20	CAPACITOR,DIPPED MICA 150PF 2% 500V	901910151
C21	CAPACITOR,DIPPED MICA 150PF 2% 500V	901910151
C22	CAPACITOR,TANT 3.3MF 10% 15V	902700335
C23	CAPACITOR,TANT 3.3MF 10% 15V	902700335
C24	CAPACITOR,TANTALUM 4.7MF 10% 50 VDCW	902700475
C25	CAPACITOR,DIPPED MICA 15PF 5% 500V	901900150
C27	CAPACITOR,DIPPED MICA 10PF 5% 500V	901950100
C32	CAPACITOR,CERAMIC,1000PF,10%,200V	901320102
C33	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C34	CAPACITOR,N/N-POLAR 12MF 20% 20V	903300126
C36	CAPACITOR,DIPPED MICA 1000PF 5% 100V	901920102
CR1	DIODE,1N4151,1 OF SET OF 3 MATCHED	A02956000
CR2	DIODE,1N4151,1 OF SET OF 3 MATCHED	A02956000
CR3	DIODE,1N4151,1 OF SET OF 3 MATCHED	A02956000
CR4	DIODE,IN4151,75V,500MW	910504151
CR5	DIODE,IN4151,75V,500MW	910504151
L1	INDUCTOR,FXD,56UH,5%,.22W	909000141
L2	INDUCTOR,FXD MOLDED 4.7UH 10% 1/4W	909000173
L3	INDUCTOR,FXD MOLDED 10UH 10% 1/4W	909000125
Q1	TRANSISTOR,SI,2N3904,NPN	910303904
Q2	TRANSISTOR,SI,2N3904,NPN	910303904
Q3	TRANSISTOR,SI,2N4392,NPN	910304392
Q4	TRANSISTOR,SI,2N3640,PNP	910303640
Q5	TRANSISTOR,SI,2N3640,PNP	910303640
Q6	TRANSISTOR,SI,2N3904,NPN	910303904
Q7	TRANSISTOR,SI,2N3640,PNP	910303640
Q8	TRANSISTOR,SI,2N3640,PNP	910303640
Q9	TRANSISTOR,SI,2N3906,PNP	910303906
Q10	TRANSISTOR,SI,2N3906,PNP	910303906
Q11	TRANSISTOR,SI,2N3904,NPN	910303904
Q12	TRANSISTOR,SI,2N3904,NPN	910303904

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
	A1 PWB ASSY (Continued)	
Q13	TRANSISTOR,MPS4274	910314274
Q14	TRANSISTOR,MPS4274	910314274
R1	RESISTOR,FXD,FILM 5.9 OHM 1/8W 1% 100PPM	907305R90
R2	RESISTOR,FXD,FILM 5.9 OHM 1/8W 1% 100PPM	907305R90
R3	RESISTOR,COMP,2K OHM,1/4W,5%	906900202
R4	RESISTOR,FXD,COMP,130K OHM 1/4W 5%	906900134
R5	RESISTOR,FXD,COMP 150 OHM 1/2W 5%	905000151
R6	RESISTOR,FILM,METAL,130 OHM,1/8W,1%	907301300
R7	RESISTOR,FXD,COMP,330 OHM 104W 5%	906900331
R8	RESISTOR,FXD,COMP,160 OHM 1/4W 5%	906900161
R9	RESISTOR,FXD,COMP,24 OHM 1/4W 5%	906900240
R10	RESISTOR,FXD,COMP,15K OHM 1/4W 5%	906900153
R11	RESISTOR,FXD,COMP,1.6K OHM,1/4W,5%	906900162
R12	RESISTOR,MET FILM 18.2K OHM 1% 1/4W	908351822
R13	RESISTOR,MET FILM 5.11K OHM 1% 1/4W	908355111
R14	RESISTOR,MET FILM 511 OHM 1% 1/4W	908355110
R15	RESISTOR,FXD,COMP,510K OHM 1/4W 5%	906900514
R16	RESISTOR,MET FILM 6.19K OHM 1% 1/4W	908356191
R17	RESISTOR,MET FILM 2.00K OHM 1% 1/4W	908352001
R18	RESISTOR,FXD,COMP 1K OHM 1/4W 5%	906900102
R19	RESISTOR,MET FILM 5.11K OHM 1% 1/4W	908355111
R20	RESISTOR,MET FILM 1.21K OHM 1% 1/4W	908351211
R21	RESISTOR, MET FILM 4.32K OHM 1% 1/4W	908354321
R22	RESISTOR,FXD,COMP,750 OHM 1/4W 5%	906900751
R23	RESISTOR,FXD,COMP,510K OHM 1/4W 5%	906900514
R24	RESISTOR,FXD,COMP,5.1K OHM 1/4W 5%	906900512
R25	RESISTOR,FXD,COMP,51 OHM 1/4W 5%	906900510
R26	RESISTOR,FXD,COMP,1.5K OHM 1/4W 5%	906900152
R27	RESISTOR, MET FILM 3.92K OHM 1% 1/4W	908353921
R28	RESISTOR, MET FILM 4.32K OHM 1% 1/4W	908354321
R29	RESISTOR,MET FILM 1.21K OHM 1% 1/4W	908351211
R30	RESISTOR,MET FILM,49.9 OHM,1%,1/8W	907300500
R31	RESISTOR,FXD,COMP,47 OHM 1/4W 5%	906900470
R32	RESISTOR, MET FILM 51.1K OHM 1% 1/4W	908355112
R33	RESISTOR,MET FILM 1.21K OHM 1% 1/4W	908351211
R34	RESISTOR,MET FILM 392 OHM 1% 1/4W	908353920
R35	RESISTOR,FXD,COMP,1.2K OHM 1/4W 5%	906900122
R36	RESISTOR,FXD,COMP,75 OHM 1/4W 5%	906900750
R37	RESISTOR,FXD,COMP,5.6K OHM 1/4W 5%	906900562
R38	RESISTOR,FXD,COMP,82 OHM 1/4W 5%	906900820
R39	RESISTOR,MET FILM 1.00K 1% 1/4W 25 PPM	908351001
R40	RESISTOR,FXD,COMP,360 OHM 1/4W 5%	906900361
R41	RESISTOR,FXD,COMP,3K OHM 1/4W 5%	906900302
R42	RESISTOR,FXD,COMP,510 OHM 1/4W 5%	906900511
R43	RESISTOR,FXD,COMP,510 OHM 1/4W 5%	906900511
R47	RESISTOR,FXD,COMP 20 OHM 1/2W 5%	905000200
R48	RESISTOR,FXD,COMP,750 OHM 1/4W 5%	906900751
R49	RESISTOR,FXD,COMP 100 OHM 1/4W 5%	906900101
R50	RESISTOR,FXD,COMP,220K OHM 1/4W 5%	906900224
R51	RESISTOR,FXD,COMP,8.2K OHM 1/4W 5%	906900822

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
	A1 PWB ASSY (Continued)	
R55	RESISTOR,FXD COMP 110K OHM 5% 1/4W	906900114
R56	RESISTOR,FXD,COMP,220K OHM 1/4W 5%	906900224
R57	RESISTOR,FXD,COMP, 12K OHM 1/4W 5%	906900123
R58	RESISTOR,FXD,COMP, 12K OHM 1/4W 5%	906900123
R59	RESISTOR,FXD,COMP,510 OHM 1/4W 5%	906900511
R60	RESISTOR,FXD,COMP 100 OHM 1/4W 5%	906900101
R61	RESISTOR,COMP,2K OHM,1/4W,5%	906900202
R62	RESISTOR,FXD,COMP 100 OHM 1/4W 5%	906900101
T1	TRANSFORMER, PULSE	909900033
T2	TRANSFORMER, PULSE T2 ALBO	909900035
U1	IC,CA3045F,TRANSISTOR ARRAY	920303045
U2	IC,CA3045F,TRANSISTOR ARRAY	920303045
U3	IC,CA3045F,TRANSISTOR ARRAY	920303045
VR1	DIODE,ZENER,1N751A,5.1V,5% 400MW	910630751
VR2	DIODE,ZENER,IN5347B,10V,5%	910635347

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
A2	PWB ASSY, A2, 418A-1	D03165900
C1	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
L1	INDUCTOR,FXD FERRITE 50MHZ .75K	909000158
R1	RESISTOR COMP,10K OHM,1/4W,5%	906900103
R2	RESISTOR,FXD,COMP 1K OHM 1/4W 5%	906900102
R3	RESISTOR,FXD,COMP 1K OHM 1/4W 5%	906900102
U1	IC,SN74L04N,HEX INVERTER	920307404
U2	IC,SN74L96N,5 BIT SHIFT REGISTER	920307496
U3	IC,SN74L96N,5 BIT SHIFT REGISTER	920307496
U4	IC,SN74L96N,5 BIT SHIFT REGISTER	920307496
U5	IC,SN74L96N,5 BIT SHIFT REGISTER	920307496
U6	IC,SN74L02N,QUAD 2 INPUT NOR GATE	920307402
U7	IC,7423PC,DUAL 4 INPUT POS NOR GATE	920307423
U8	IC,7423PC,DUAL 4 INPUT POS NOR GATE	920307423
U9	IC,7423PC,DUAL 4 INPUT POS NOR GATE	920307423
U10	IC,DM74L86N,QUAD 2 INPUT EXCLUSIVE OR GATE	920307486
U11	IC,SN74L00N,QUAD 2 INPUT POS NAND GATE	920317400
U12	IC,SN74LS20N,DUAL 4-INPUT NAND GATE	920307420
U13	IC,93L28DC,DUAL 8 BIT SHIFT REGISTER	920309328
U14	IC,SN74L96N,5 BIT SHIFT REGISTER	920307496
U15	IC,74L73N	920300076
U16	IC,SN74L00N,QUAD 2 INPUT POS NAND GATE	920317400

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
A3	PWB ASSY, A3, 418A-1	D03166000
C1	CAPACITOR,CERAMIC .01MF 10% 200V	901330103
C2	CAPACITOR,CERAMIC .01MF 10% 200V	901330103
C4	CAPACITOR,CERAMIC .01MF 10% 200V	901330103
C6	CAPACITOR,CERAMIC .01MF 10% 200V	901330103
C10	CAPACITOR,CERAMIC .01MF 10% 200V	901330103
C11	CAPACITOR,DIPPED MICA 15PF 5% 500V	901900150
C16	CAPACITOR,CERAMIC 100PF 10% 100V	901300101
C17	CAPACITOR,CERAMIC .01MF 10% 200V	901330103
C19	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C21	CAPACITOR,DIPPED MICA 15PF 5% 500V	901900150
C22	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
CR1	DIODE,SI,IN4148,75V,150MA,500MW	910504148
CR3	DIODE,GE,IN3666,80V,200MA,75MW	910503666
L1	INDUCTOR,FXD FERRITE 50MHZ .75K	909000158
Q1	TRANSISTOR,SI,2N3904,NPN	910303904
Q2	TRANSISTOR,SI,2N3904,NPN	910303904
Q4	TRANSISTOR,SI,2N3906,PNP	910303906
Q5	TRANSISTOR,SI,2N3904,NPN	910303904
R1	RESISTOR COMP,10K OHM,1/4W,5%	906900103
R4	RESISTOR,FXD,COMP, 12K OHM 1/4W 5%	906900123
R5	RESISTOR,FXD,COMP, 12K OHM 1/4W 5%	906900123
R6	RESISTOR,FXD,COMP,360 OHM 1/4W 5%	906900361
R7	RESISTOR,FXD,COMP,510 OHM 1/4W 5%	906900511
R8	RESISTOR,FXD,COMP,22K OHM 1/4W 5%	906900223
R9	RESISTOR,FXD,COMP,330 OHM 104W 5%	906900331
R11	RESISTOR,FXD COMP 3.3K OHM 5% 1/4W	906900322
R13	RESISTOR,FXD,FILM 6.19K OHM 1/8W 1%	907306191
R14	CERMET TRIMMER 20K 20% .5W PC MTG	907900259
R15	RESISTOR,FXD,FILM 2.05K OHM 1/8W 1%	907302051
R17	RESISTOR,FXD,COMP,4.7K OHM 1/4W 5%	906900472
R18	RESISTOR,FXD,COMP 1K OHM 1/4W 5%	906900102
R19	RESISTOR,FXD COMP 3.3K OHM 5% 1/4W	906900322
R32	RESISTOR COMP,10K OHM,1/4W,5%	906900103
U1	IC,SN74L04N,HEX INVERTER	920307404
U2	IC,SN74L90N,DECADE COUNTER	920307490
U3	IC,SN74L90N,DECADE COUNTER	920307490
U4	IC,SN74L123N,DUAL FLIP-FLOP	920374123
U5	IC,SN74L10N,TRIPLE 3 INPUT POS NAND GATE	920307410
U6	IC,SN74L10N,TRIPLE 3 INPUT POS NAND GATE	920307410
U7	IC,SN74L00N,QUAD 2 INPUT POS NAND GATE	920317400
U8	IC,DM74L93N,BINARY COUNTER	920307493
U9	IC,74L73N	920300076
U10	IC,SN74L74N,DUAL D FLIP-FLOP	920307474
U11	IC,SN74L00N,QUAD 2 INPUT POS NAND GATE	920317400

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
A2	PWB ASSY, A2, 418A-1	D03165900
C1	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
L1	INDUCTOR,FXD FERRITE 50MHZ .75K	909000158
R1	RESISTOR COMP,10K OHM,1/4W,5%	906900103
R2	RESISTOR,FXD,COMP 1K OHM 1/4W 5%	906900102
R3	RESISTOR,FXD,COMP 1K OHM 1/4W 5%	906900102
U1	IC,SN74L04N,HEX INVERTER	920307404
U2	IC,SN74L96N,5 BIT SHIFT REGISTER	920307496
U3	IC,SN74L96N,5 BIT SHIFT REGISTER	920307496
U4	IC,SN74L96N,5 BIT SHIFT REGISTER	920307496
U5	IC,SN74L96N,5 BIT SHIFT REGISTER	920307496
U6	IC,SN74L02N,QUAD 2 INPUT NOR GATE	920307402
U7	IC,7423PC,DUAL 4 INPUT POS NOR GATE	920307423
U8	IC,7423PC,DUAL 4 INPUT POS NOR GATE	920307423
U9	IC,7423PC,DUAL 4 INPUT POS NOR GATE	920307423
U10	IC,DM74L86N,QUAD 2 INPUT EXCLUSIVE OR GATE	920307486
U11	IC,SN74L00N,QUAD 2 INPUT POS NAND GATE	920317400
U12	IC,SN74LS20N,DUAL 4-INPUT NAND GATE	920307420
U13	IC,93L28DC,DUAL 8 BIT SHIFT REGISTER	920309328
U14	IC,SN74L96N,5 BIT SHIFT REGISTER	920307496
U15	IC,74L73N	920300076
U16	IC,SN74L00N,QUAD 2 INPUT POS NAND GATE	920317400

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
A3	PWB ASSY, A3, 418A-1	D03166000
C1	CAPACITOR,CERAMIC .01MF 10% 200V	901330103
C2	CAPACITOR,CERAMIC .01MF 10% 200V	901330103
C4	CAPACITOR,CERAMIC .01MF 10% 200V	901330103
C6	CAPACITOR,CERAMIC .01MF 10% 200V	901330103
C10	CAPACITOR,CERAMIC .01MF 10% 200V	901330103
C11	CAPACITOR,DIPPED MICA 15PF 5% 500V	901900150
C16	CAPACITOR,CERAMIC 100PF 10% 100V	901300101
C17	CAPACITOR,CERAMIC .01MF 10% 200V	901330103
C19	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C21	CAPACITOR,DIPPED MICA 15PF 5% 500V	901900150
C22	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
CR1	DIODE,SI,IN4148,75V,150MA,500MW	910504148
CR3	DIODE,GE,IN3666,80V,200MA,75MW	910503666
L1	INDUCTOR,FXD FERRITE 50MHZ .75K	909000158
Q1	TRANSISTOR,SI,2N3904,NPN	910303904
Q2	TRANSISTOR,SI,2N3904,NPN	910303904
Q4	TRANSISTOR,SI,2N3906,PNP	910303906
Q5	TRANSISTOR,SI,2N3904,NPN	910303904
R1	RESISTOR COMP,10K OHM,1/4W,5%	906900103
R4	RESISTOR,FXD,COMP, 12K OHM 1/4W 5%	906900123
R5	RESISTOR,FXD,COMP, 12K OHM 1/4W 5%	906900123
R6	RESISTOR,FXD,COMP,360 OHM 1/4W 5%	906900361
R7	RESISTOR,FXD,COMP,510 OHM 1/4W 5%	906900511
R8	RESISTOR,FXD,COMP,22K OHM 1/4W 5%	906900223
R9	RESISTOR,FXD,COMP,330 OHM 104W 5%	906900331
R11	RESISTOR,FXD COMP 3.3K OHM 5% 1/4W	906900322
R13	RESISTOR,FXD,FILM 6.19K OHM 1/8W 1%	907306191
R14	CERMET TRIMMER 20K 20% .5W PC MTG	907900259
R15	RESISTOR,FXD,FILM 2.05K OHM 1/8W 1%	907302051
R17	RESISTOR,FXD,COMP,4.7K OHM 1/4W 5%	906900472
R18	RESISTOR,FXD,COMP 1K OHM 1/4W 5%	906900102
R19	RESISTOR,FXD COMP 3.3K OHM 5% 1/4W	906900322
R32	RESISTOR COMP,10K OHM,1/4W,5%	906900103
U1	IC,SN74L04N,HEX INVERTER	920307404
U2	IC,SN74L90N,DECADE COUNTER	920307490
U3	IC,SN74L90N,DECADE COUNTER	920307490
U4	IC,SN74L123N,DUAL FLIP-FLOP	920374123
U5	IC,SN74L10N,TRIPLE 3 INPUT POS NAND GATE	920307410
U6	IC,SN74L10N,TRIPLE 3 INPUT POS NAND GATE	920307410
U7	IC,SN74L00N,QUAD 2 INPUT POS NAND GATE	920317400
U8	IC,DM74L93N,BINARY COUNTER	920307493
U9	IC,74L73N	920300076
U10	IC,SN74L74N,DUAL D FLIP-FLOP	920307474
U11	IC,SN74L00N,QUAD 2 INPUT POS NAND GATE	920317400

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
A4	PWB ASSY, A4, 418A-1	D03166100
C1	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C2	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C3	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C6	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
CR1	DIODE,GE,IN3666,80V,200MA,75MW	910503666
CR4	CAPACITOR,CERAMIC .01MF 10% 200V	901330103
CR5	CAPACITOR,CERAMIC .01MF 10% 200V	901330103
L1	INDUCTOR,FXD FERRITE 50MHZ .75K	909000158
Q1	TRANSISTOR,SI,2N3904,NPN	910303904
Q2	TRANSISTOR,SI,2N2907,PNP	910302907
R1	RESISTOR COMP,10K OHM,1/4W,5%	906900103
R2	RESISTOR COMP,10K OHM,1/4W,5%	906900103
R3	RESISTOR,FXD,COMP 1K OHM 1/4W 5%	906900102
R4	RESISTOR,FXD,COMP 1K OHM 1/4W 5%	906900102
R5	RESISTOR,FXD,COMP 100 OHM 1/4W 5%	906900101
R6	RESISTOR COMP,10K OHM,1/4W,5%	906900103
R7	RESISTOR COMP,10K OHM,1/4W,5%	906900103
R8	RESISTOR COMP,10K OHM,1/4W,5%	906900103
R9	RESISTOR COMP,10K OHM,1/4W,5%	906900103
R10	RESISTOR COMP,10K OHM,1/4W,5%	906900103
R11	RESISTOR,FXD,COMP 100 OHM 1/4W 5%	906900101
R12	RESISTOR COMP,10K OHM,1/4W,5%	906900103
R13	RESISTOR COMP,10K OHM,1/4W,5%	906900103
U1	IC,SN74L02N,QUAD 2 INPUT NOR GATE	920307402
U2	IC,SN74L00N,QUAD 2 INPUT POS NAND GATE	920317400
U3	IC,DM74151AN,DATA SELECTOR/MULTIPLEXER	920374151
U4	IC,SN74L96N,5 BIT SHIFT REGISTER	920307496
U5	IC,SN74L96N,5 BIT SHIFT REGISTER	920307496
U6	IC,74L73N	920300076
U7	IC,74L73N	920300076
U8	IC,SN74L00N,QUAD 2 INPUT POS NAND GATE	920317400
U9	IC,SN74L90N,DECADE COUNTER	920307490
U10	IC,SN74L90N,DECADE COUNTER	920307490
U11	IC,SN74L90N,DECADE COUNTER	920307490
U12	IC,SN74157N,QUAD DATA SELECTOR	920374157
U13	IC,SN74157N,QUAD DATA SELECTOR	920374157
U14	IC,SN74157N,QUAD DATA SELECTOR	920374157
U15	IC,SN74L90N,DECADE COUNTER	920307490
U16	IC,SN74L90N,DECADE COUNTER	920307490
U17	IC,SN74L90N,DECADE COUNTER	920307490
U18	IC,74L73N	920300076

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
A5	PWB ASSY, A5, 418A-1	D03166200
C1	CAPACITOR,CERAMIC .01MF 10% 200V	901330103
C2	CAPACITOR,CERAMIC .01MF 10% 200V	901330103
C3	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C4	CAPACITOR,NPO 33PF 2% 100V	901410330
C8	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C9	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C10	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C11	CAPACITOR,CERAMIC,1000PF,10%,200V	901320102
C12	CAPACITOR,CERAMIC,1000PF,10%,200V	901320102
C13	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C14	CAPACITOR,CERAMIC,1000PF,10%,200V	901320102
L1	INDUCTOR,FXD FERRITE 50MHZ .75K	909000158
L2	INDUCTOR,FXD FERRITE 50MHZ .75K	909000158
L3	INDUCTOR,FXD FERRITE 50MHZ .75K	909000158
Q1	TRANSISTOR,SI,PN4258/2N4258,NPN	910304258
Q2	TRANSISTOR,SI,PN4258/2N4258,NPN	910304258
Q3	TRANSISTOR,SI,PN4258/2N4258,NPN	910304258
Q4	TRANSISTOR,SI,2N2905,NPN	910302905
R1	RESISTOR,FXD,FILM 43.2K OHM 1/8W 1%	907304322
R2	RESISTOR,FAX,FILM 2.43K OHM,1/8W 1%	907302431
R3	RESISTOR,FAX,FILM 2.43K OHM,1/8W 1%	907302431
R4	RESISTOR,METAL,FILM,1.21K OHM,1/8W,1%	907301211
R5	RESISTOR,FXD,FILM 432 OHM 1/8W 1%	907304320
R6	RESISTOR,FXD,FILM 1.82K OHM 1/8W 1%	907301821
R7	RESISTOR,FXD,COMP 1K OHM 1/4W 5%	906900102
R8	RESISTOR,FXD,FILM 1.82K OHM 1/8W 1%	907301821
R9	RESISTOR,FXD,COMP,2.2K OHM 1/4W 5%	906900222
R10	RESISTOR,FXD,COMP,2.2K OHM 1/4W 5%	906900222
R11	RESISTOR,FXD,COMP 100 OHM 1/4W 5%	906900101
R12	RESISTOR,FXD,COMP 100K OHM 1/4W 5%	906900104
R13	RESISTOR COMP,10K OHM,1/4W,5%	906900103
R14	RESISTOR COMP,10K OHM,1/4W,5%	906900103
R15	RESISTOR,FXD,COMP 100 OHM 1/4W 5%	906900101
R16	RESISTOR COMP,10K OHM,1/4W,5%	906900103
R17	RESISTOR COMP,10K OHM,1/4W,5%	906900103
R18	RESISTOR COMP,10K OHM,1/4W,5%	906900103
R19	RESISTOR COMP,10K OHM,1/4W,5%	906900103
R20	RESISTOR,FXD,COMP,33K OHM 1/4W 5%	906900333
R21	RESISTOR,FILM,METAL,110 OHM,1/8W,1%	907301100
U1	IC,SN74L00N,QUAD 2 INPUT POS NAND GATE	920317400
U2	IC,SN74L00N,QUAD 2 INPUT POS NAND GATE	920317400
U3	IC,DM74L93N,BINARY COUNTER	920307493
U4	IC,DM74L93N,BINARY COUNTER	920307493
U5	IC,DM74L93N,BINARY COUNTER	920307493
U6	IC,SN74L00N,QUAD 2 INPUT POS NAND GATE	920317400
U7	IC,SN74L30,8 INPUT POS NAND GATE	920307430
U8	IC,SN74L90N,DECADE COUNTER	920307490
U9	IC,SN74L90N,DECADE COUNTER	920307490
U10	IC,SN74L00N,QUAD 2 INPUT POS NAND GATE	920317400
U11	IC,SN74L90N,DECADE COUNTER	920307490

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
	A5 PWB ASSY (Continued)	
U12	IC,SN74L90N,DECADE COUNTER	920307490
U13	IC,SN74L90N,DECADE COUNTER	920307490
U14	IC,CA3127E,TRANSISTOR ARRAY,NPN	920303127
XY1	SOCKET,CRYSTAL HORIZONTAL, PC MTG	914200056
Y1	CRYSTAL, 1.544MHZ	912200174

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
A6	PWB ASSY, A6, 418A-1	D03166300
C1	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C2	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C3	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C4	CAPACITOR,TANTALUM 22MF 20% 15V	902740226
C5	CAPACITOR,DIPPED MICA 270PF 5% 500V	901900271
C6	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C7	CAPACITOR,CER,4700PF,10%,100V	901320472
L1	INDUCTOR,FXD FERRITE 50MHZ .75K	909000158
L2	INDUCTOR,FXD FERRITE 50MHZ .75K	909000158
L3	INDUCTOR,FXD FERRITE 50MHZ .75K	909000158
L4	INDUCTOR,FXD FERRITE 50MHZ .75K	909000158
L5	INDUCTOR,FXD,10%,2	909000139
Q1	TRANSISTOR,SI,2N4265,NPN	910304265
Q2	TRANSISTOR,SI,2N4265,NPN	910304265
Q3	TRANSISTOR,SI,PN4258/2N4258,NPN	910304258
Q4	TRANSISTOR,SI,PN4258/2N4258,NPN	910304258
Q5	TRANSISTOR,SI,2N4265,NPN	910304265
Q6	TRANSISTOR,SI,2N4265,NPN	910304265
R1	RESISTOR,FXD,FILM 10K OHM 1/8W 1%	907301002
R2	RESISTOR,FXD,FILM 10K OHM 1/8W 1%	907301002
R3	RESISTOR,FXD,FILM 10K OHM 1/8W 1%	907301002
R4	RESISTOR,FXD,FILM 3.01K OHM 1/8W 1%	907303011
R5	RESISTOR,FXD,FILM 97.6 OHM 1/8W 1% 100PPM	907397R60
R6	RESISTOR,FXD,FILM 3.01K OHM 1/8W 1%	907303011
R7	RESISTOR,FXD,FILM 3.01K OHM 1/8W 1%	907303011
R8	RESISTOR,FXD,FILM 97.6 OHM 1/8W 1% 100PPM	907397R60
R9	RESISTOR,FXD,FILM 3.01K OHM 1/8W 1%	907303011
R12	RESISTOR,FXD,COMP 100 OHM 1/4W 5%	906900101
R13	RESISTOR,FXD,FILM 464 OHM 1/8W 1%	907304640
R14	RESISTOR,FXD,FILM 464 OHM 1/8W 1%	907304640
R15	RESISTOR,FXD,FILM 464 OHM 1/8W 1%	907304640
R16	RESISTOR,FXD,FILM 17.4 OHM 1/8W 1% 100PPM	907317R40
R17	RESISTOR,FXD,FILM 17.4 OHM 1/8W 1% 100PPM	907317R40
R18	RESISTOR,FXD,FILM 17.4 OHM 1/8W 1% 100PPM	907317R40
R19	RESISTOR,FXD,FILM 17.4 OHM 1/8W 1% 100PPM	907317R40
R20	RESISTOR,FXD,FILM 17.4 OHM 1/8W 1% 100PPM	907317R40
R21	RESISTOR,FXD,FILM 17.4 OHM 1/8W 1% 100PPM	907317R40
R22	RESISTOR,FXD,FILM 17.4 OHM 1/8W 1% 100PPM	907317R40
R23	RESISTOR,FXD,FILM 17.4 OHM 1/8W 1% 100PPM	907317R40
T1	TRANSFORMER PULSE ENG	909900038
U1	IC,SN74L04N,HEX INVERTER	920307404
U2	IC,SN74L00N,QUAD 2 INPUT POS NAND GATE	920317400
U3	IC,74L73N	920300076
U4	IC,DM74L86N,QUAD 2 INPUT EXCLUSIVE OR GATE	920307486
U5	IC,SN74L02N,QUAD 2 INPUT NOR GATE	920307402
U6	IC,7427PC,TRIPLE 3 INPUT NOR GATE	920307427
U7	IC,SN74L96N,5 BIT SHIFT REGISTER	920307496
U8	IC,SN74L96N,5 BIT SHIFT REGISTER	920307496
U9	IC,SN74L96N,5 BIT SHIFT REGISTER	920307496
U10	IC,SN74L96N,5 BIT SHIFT REGISTER	920307496

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
	A6 PWB ASSY (Continued)	
U11	IC,7423PC,DUAL 4 INPUT POS NOR GATE	920307423
U12	IC,7423PC,DUAL 4 INPUT POS NOR GATE	920307423
U13	IC,SN74LS20N,DUAL 4-INPUT NAND GATE	920307420
U14	IC,SN74L30,8 INPUT POS NAND GATE	920307430
U15	IC,74L73N	920300076

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
A7	PWB ASSY, A7, 418A-1	D03166400
C1	CAPACITOR,ELECTROLYTIC 1000 MF 10% 50V	902280108
C2	CAPACITOR,ELECTROLYTIC 1000 MF 10% 50V	902280108
C5	CAPACITOR,ELECTROLYTIC 1000 MF 10% 50V	902280108
C6	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C7	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C8	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C9	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C10	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C11	CAPACITOR TANTALUM 10MF 10%,20V	902720106
C12	CAPACITOR TANTALUM 10MF 10%,20V	902720106
C13	CAPACITOR TANTALUM 10MF 10%,20V	902720106
C14	CAPACITOR TANTALUM 10MF 10%,20V	902720106
C15	CAPACITOR,TANTALUM 1.0MF 50V	902760105
C16	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C17	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C18	CAPACITOR TANTALUM 10MF 10%,20V	902720106
CR2	DIODE,RECTIFIER,IN5818,1.0AMP,50V	910805818
CR3	DIODE,RECTIFIER,IN5818,1.0AMP,50V	910805818
CR4	DIODE,SI,IN4148,75V,150MA,500MW	910504148
CR5	DIODE,IN5296,0.91MA	910505296
CR6	DIODE,IN5296,0.91MA	910505296
L2	INDUCTOR,FXD FERRITE 50MHZ .75K	909000158
L1	INDUCTOR,FXD FERRITE 50MHZ .75K	909000158
Q1	TRANSISTOR,SI,2N2219,NPN	910302219
Q4	TRANSISTOR,SI,2N4234,PNP	910304234
Q6	TRANSISTOR,SI,2N3904,NPN	910303904
Q8	TRANSISTOR,SI,2N3904,NPN	910303904
Q9	TRANSISTOR,SI,2N3904,NPN	910303904
Q10	TRANSISTOR,SI,2N3906,PNP	910303906
Q11	TRANSISTOR,SI,2N2222,NPN	910302222
Q12	TRANSISTOR,SI,2N2222,NPN	910302222
Q13	TRANSISTOR,SI,2N2219,NPN	910302219
Q14	TRANSISTOR,SI,2N2219,NPN	910302219
R1	RESISTOR,FXD,COMP 1.2K OHM 1W 5%	905400122
R3	RESISTOR,FXD,FILM 243 OHM 1/8W 1% 100PPM	907302430
R4	RESISTOR,FXD,FILM 10K OHM 1/8W 1%	907301002
R6	RESISTOR,FXD,FILM 2.21K OHM 1/8W 1%	907302211
R8	RESISTOR,FXD,FILM 4.02K OHM 1/8W 1%	907304021
R9	RESISTOR,FXD,FILM 10K OHM 1/8W 1%	907301002
R10	RESISTOR,FXD,FILM 2.21K OHM 1/8W 1%	907302211
R11	RESISTOR,FXD,FILM 10K OHM 1/8W 1%	907301002
R12	RESISTOR,FILM,METAL,604 OHM,1/8W,1%	907306040
R13	POTENTIOMETER 1K 10% 15 TURN PC MTG	907900290
R14	RESISTOR,FXD,FILM 3.57K OHM 1/8W 1%	907303571
R15	RESISTOR,FXD,FILM 15.0K OHM 1/8W 1%	907301502
R16	RESISTOR,FXD,FILM 1.0K OHM 1/8W 1%	907301001
R17	RESISTOR,FXD,FILM 464 OHM 1/8W 1%	907304640
R18	RESISTOR,FXD,FILM 10K OHM 1/8W 1%	907301002
R19	RESISTOR,FXD,FILM 10K OHM 1/8W 1%	907301002
R20	RESISTOR,FXD,FILM 33.2K OHM 1/8W 1%	907303322

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
	A7 PWB ASSY (Continued)	
R21	RESISTOR,FXD,COMP,22K OHM 1/4W 5%	906900223
R22	RESISTOR,FXD,COMP,22K OHM 1/4W 5%	906900223
R23	RESISTOR,FXD,FILM 10K OHM 1/8W 1%	907301002
R24	RESISTOR,FXD,FILM 1.0K OHM 1/8W 1%	907301001
R25	RESISTOR,FXD,FILM 1.0K OHM 1/8W 1%	907301001
R26	POTENTIOMETER 1K 10% 15 TURN PC MTG	907900290
R27	RESISTOR,FXD,FILM 1.0K OHM 1/8W 1%	907301001
R28	RESISTOR,FXD,FILM 147K OHM 1/8W 1%	907301473
R29	RESISTOR,FXD,COMP,2.2K OHM 1/4W 5%	906900222
R30	RESISTOR,FXD,COMP,2.2K OHM 1/4W 5%	906900222
R31	RESISTOR,FXD,COMP,68 OHM 1/4W 5%	906900680
R32	RESISTOR,FXD,COMP,22 OHM 1/4W 5%	906900220
R33	RESISTOR,FXD,COMP,68 OHM 1/4W 5%	906900680
R34	RESISTOR,FXD,COMP,22 OHM 1/4W 5%	906900220
R35	RESISTOR,FXD,FILM 10K OHM 1/8W 1%	907301002
R36	RESISTOR,FXD,COMP 120 OHM 1/4W 5%	906900121
R37	RESISTOR,FXD,COMP 120 OHM 1/4W 5%	906900121
R38	RESISTOR,FXD,COMP, 1.8K OHM 1/4W 5%	906900182
T1	TRANSFORMER DC/DC CONVERTER	909900040
U3	IC,MC3302P	920303320
U4	IC,DM74L93N,BINARY COUNTER	920307493
U5	IC,74L73N	920300076
U6	IC,AD580K,LOW DRIFT VOLTAGE	920300580

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
A8	PWB ASSY, A8, 418A-1	D03284600
J1	CONNECTOR .156 CONTACT SPACING	914800234
J2	CONNECTOR .156 CONTACT SPACING	914800234
J3	CONNECTOR .156 CONTACT SPACING	914800234
J4	CONNECTOR .156 CONTACT SPACING	914800234
J5	CONNECTOR .156 CONTACT SPACING	914800234
J6	CONNECTOR .156 CONTACT SPACING	914800234
J7	CONNECTOR .156 CONTACT SPACING	914800234
J8	CONNECTOR, 22/44	C03206200
J9	CONNECTOR .156 CONTACT SPACING	914800234
J10	CONNECTOR,PC MTG WAFER ASSY POLARIZING	914800203
J11	CONNECTOR,NYLON	914800240

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
A9	PWB ASSY, A9, 418A-1	D03166500
C1	CAPACITOR,CERAMIC .01MF 10% 200V	901330103
DS1	DISPLAY,LED NUMERICAL	913800053
DS2	DISPLAY,LED NUMERICAL	913800053
DS3	DISPLAY,LED NUMERICAL	913800053
DS4	LED,10MADC,120MW	910504684
DS5	LED,10MADC,120MW	910504684
DS7	LED,10MADC,120MW	910504684
DS8	LED,10MADC,120MW	910504684
DS9	LED,10MADC,120MW	910504684
DS10	LED,10MADC,120MW	910504684
J1	SOCKET,IC DUAL IN-LINE 14 PIN	914200055
J2	SOCKET,IC DUAL IN-LINE 14 PIN	914200055
R1	RESISTOR,FXD,COMP,220 OHM 1/4W 5%	906900221
R2	RESISTOR,FXD,COMP,220 OHM 1/4W 5%	906900221
R4	RESISTOR,FXD,COMP,220 OHM 1/4W 5%	906900221
R5	RESISTOR,FXD,COMP,220 OHM 1/4W 5%	906900221
R6	RESISTOR,FXD,COMP,220 OHM 1/4W 5%	906900221
R7	RESISTOR,FXD,COMP,220 OHM 1/4W 5%	906900221
U1	IC,SN74L04N,HEX INVERTER	920307404

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
A10	PWB ASSY, A10, 418A-1	D03252900
C1	CAPACITOR,RADIAL LEADS 0.1MF,10%,100V	901330104
C2	CAPACITOR DIPPED MICA 100PF,5%,500V	901900101
C3	CAPACITOR DIPPED MICA 100PF,5%,500V	901900101
CR1	DIODE,GE,IN3666,80V,200MA,75MW	910503666
J1	CONNECTOR,PC CARD EDGE 12 POS	914800230
J2	CONNECTOR,PC CARD EDGE 12 POS	914800230
J3	CONNECTOR,PC CARD EDGE 12 POS	914800230
J4	CONNECTOR,PC CARD EDGE 12 POS	914800230
J5	CONNECTOR,PC CARD EDGE 12 POS	914800230
J6	CONNECTOR,PC CARD EDGE 12 POS	914800230
J7	CONNECTOR,12 PIN PC MTG	914800281
J8	CONNECTOR,4 PIN PC MTG	914800277
J9	CONNECTOR,4 PIN PC MTG	914800277
J10	CONNECTOR,9 PIN PC MTG	914800279
J11	CONNECTOR,4 PIN PC MTG	914800277
R1	RESISTOR COMP,10K OHM,1/4W,5%	906900103
R2	RESISTOR COMP,10K OHM,1/4W,5%	906900103
R3	RESISTOR,FXD,COMP,22K OHM 1/4W 5%	906900223
R4	RESISTOR,FXD,COMP,22K OHM 1/4W 5%	906900223
R5	RESISTOR,FXD,COMP,8.2K OHM 1/4W 5%	906900822
R6	RESISTOR,FXD,COMP,8.2K OHM 1/4W 5%	906900822
R7	RESISTOR COMP,10K OHM,1/4W,5%	906900103
R8	RESISTOR COMP,10K OHM,1/4W,5%	906900103
RP1	RESISTOR,10K OHM,1/8W,2%	920660103
RP2	RESISTOR,10K OHM,1/8W,2%	920660103
RP3	RESISTOR,10K OHM,1/8W,2%	920660103
RP4	RESISTOR,10K OHM,1/8W,2%	920660103
RP5	RESISTOR,10K OHM,1/8W,2%	920660103
RP6	RESISTOR,ISOLATED NETWORK 1K OHM 2% 1/8W	920880102
RP7	RESISTOR,ISOLATED NETWORK 1K OHM 2% 1/8W	920880102
S1	SWITCH,ROTARY 6POS,1SEC	911200247
S2	SWITCH,1 POLE,9 POS,1 SEC	911200248
S3	SWITCH,ROTARY 5POS 2SEC	911200246
U1	IC,SN74L192N,UP/DOWN DECADE COUNTER	920374192
U2	IC,SN74L192N,UP/DOWN DECADE COUNTER	920374192
U3	IC,74L73N	920300076
U4	IC,SN74L192N,UP/DOWN DECADE COUNTER	920374192
U5	IC,SN74L192N,UP/DOWN DECADE COUNTER	920374192
U6	IC,SN74L192N,UP/DOWN DECADE COUNTER	920374192
U7	IC,SN74L192N,UP/DOWN DECADE COUNTER	920374192
U8	IC,SN74L192N,UP/DOWN DECADE COUNTER	920374192
U9	IC,SN74L192N,UP/DOWN DECADE COUNTER	920374192
U10	IC,SN74L10N,TRIPLE 3 INPUT POS NAND GATE	920307410
U11	IC,SN74L00N,QUAD 2 INPUT POS NAND GATE	920317400
U12	IC,SN74L00N,QUAD 2 INPUT POS NAND GATE	920317400
U13	IC,SN74L123N,DUAL FLIP-FLOP	920374123
W1	ASSY,CABLE,8.0IN,14 PIN INTERCONNECT	916400040
W2	ASSY,CABLE,8.0IN,14 PIN INTERCONNECT	916400040

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
FP	ASSY, FRONT PANEL, 418A-1	D03205100
C1	CAPACITOR,MYLAR 0.22 MF 3% 200V	901100224
C2	CAPACITOR,MYLAR 0.22 MF 3% 200V	901100224
C3	CAPACITOR,DIPPED MICA 5600PF 5% 300V	901900562
DS11	LED,MV5025,70MA 1.6VDC	910505025
DS12	LED,MV5025,70MA 1.6VDC	910505025
E1	INSULATOR STANDOFF TERMINAL CERAMIC	915100010
E2	INSULATOR STANDOFF TERMINAL CERAMIC	915100010
FL1	INDUSTRIAL EMI/RFI LINE FILTER	910100181
J1	JACK,PHONE 310	914400024
J2	JACK PHONE INSULATED TIP JACK	914400032
J3	JACK PHONE INSULATED TIP JACK	914400032
J4	JACK PHONE INSULATED TIP JACK	914400032
J5	JACK PHONE INSULATED TIP JACK	914400032
J6	JACK PHONE INSULATED TIP JACK	914400032
J7	JACK,PHONE 310	914400024
J8	JACK,PHONE 310	914400024
J9	JACK,PHONE 310	914400024
J10	JACK,PHONE 310	914400024
J11	JACK PHONE INSULATED TIP JACK	914400032
J12	JACK PHONE INSULATED TIP JACK	914400032
J13	JACK PHONE INSULATED TIP JACK	914400032
J14	JACK PHONE INSULATED TIP JACK	914400032
J15	JACK PHONE INSULATED TIP JACK	914400032
J16	JACK,BNC	914600035
L1	INDUCTOR,FXD,56UH,5%,.22W	909000141
Q2	TRANSISTOR,SI,40251,NPN	910340251
R2	RESISTOR,FXD,FILM 464 OHM 1/8W 1%	907304640
R3	RESISTOR,FXD,FILM 464 OHM 1/8W 1%	907304640
R4	RESISTOR,FXD,FILM 26.1 OHM	907326R10
R5	RESISTOR,FXD,FILM 100 OHM 1/8W 1%	907301000
R6	RESISTOR,FXD,FILM 100 OHM 1/8W 1%	907301000
R7	RESISTOR,FXD,FILM 383 OHM 1/8W 1%	907303830
R8	RESISTOR,FXD,COMP 100 OHM 1/4W 5%	906900101
R9	RESISTOR,FXD,COMP 100 OHM 1/4W 5%	906900101
R10	RESISTOR,FXD,COMP 100 OHM 1/4W 5%	906900101
R11	RESISTOR,FXD,COMP 100 OHM 1/4W 5%	906900101
S1	SWITCH,TOGGLE,3PDT,5AMP,120VAC/28VDC	911000069
S2	SWITCH,TOGGLE,3PDT,5AMP,120VAC/28VDC	911000069
S3	SWITCH,TOGGLE,3PDT,5AMP,120VAC/28VDC	911000069
S4	SWITCH,TOGGLE,DPDT,5A,120VAC	911000076
S5	SWITCH,TOGGLE,DPDT,5A,120VAC	911000076
S6	SWITCH,PUSHBUTTON, SPST	911300004
S7	SWITCH,TOGGLE,DPDT,5A,120VAC	911010068
S8	SWITCH,ASSY	C03213400
S9	SWITCH,PUSHBUTTON,SPDT,STEEL,PLUNGER	911300060
S10	SWITCH,PUSHBUTTON, SPST	911300004

REF DESIG	DESCRIPTION	SIERRA PART NUMBER
PP	ASSY, POWER PANEL, 418A-1	D03092100
CR1	DIODE,BRIDGE RECTIFIER,MDA960-1,50V	910800025
F1	FUSE,SLO-BLOW 0.5A 250V	913200039
F2	FUSE,LITTLEFUSE TYPE 3AG 3A	913200002
Q2	TRANSISTOR,SI,40251,NPN	910340251
R1	RESISTOR MET FILM 619 OHM 1% 1/8W	907306190
S1	SWITCH,SLIDE DPDT	911000040
TC	TRANSFORMER POWER 115/230VAC PRI	910000132
U1	IC,LM317K,VOLTAGE REGULATOR	920300317
XF1	FUSE HOLDER	913400012
XF2	FUSE HOLDER	913400012
XU1	SOCKET, TRANSISTOR POWER	914200051
YQ2	SOCKET, TRANSISTOR POWER	914200051

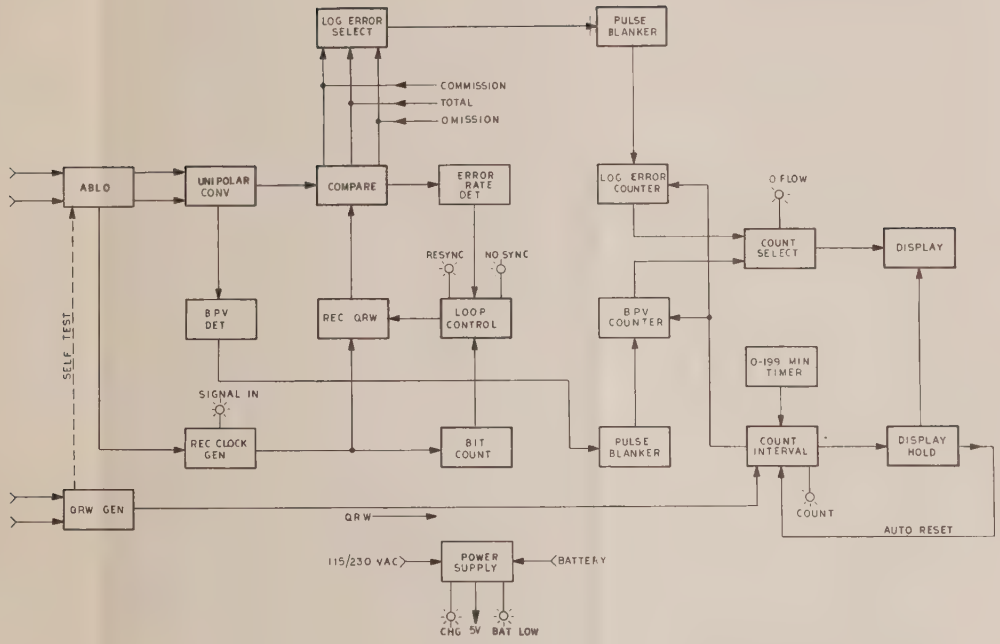


Figure 9-1
Block Diagram

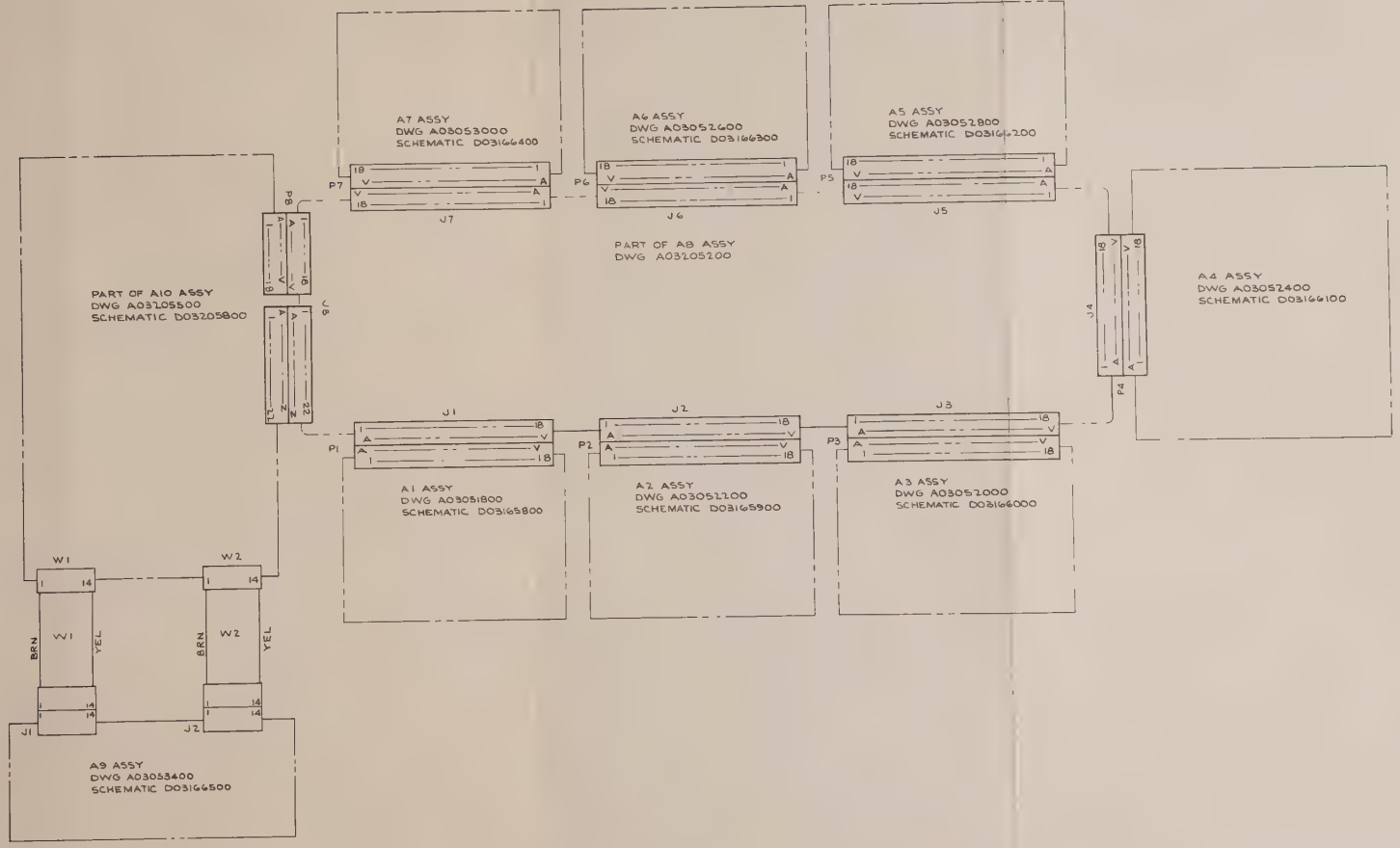


Figure 9-2 (Sheet 1 of 4)
Interconnect Diagram

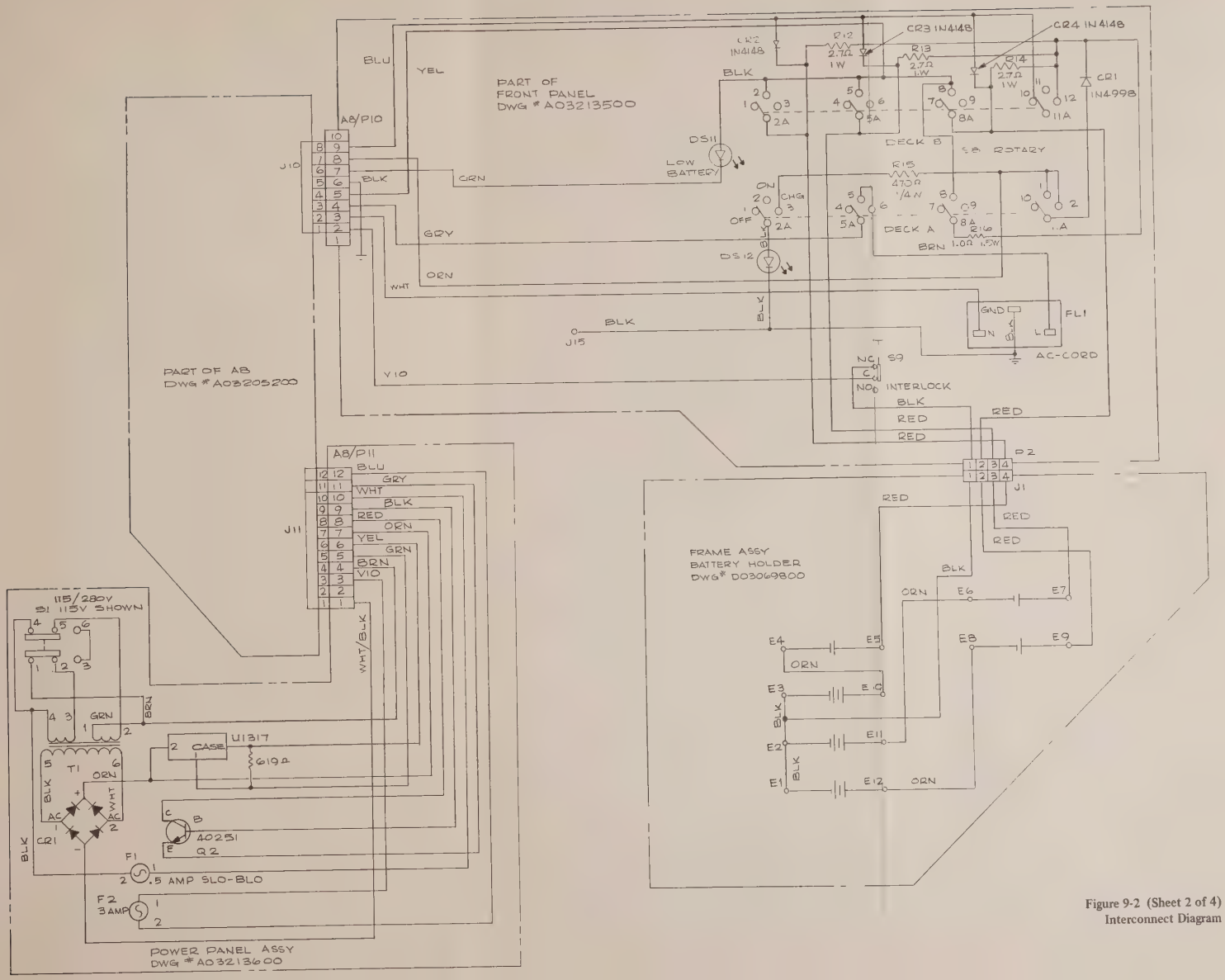
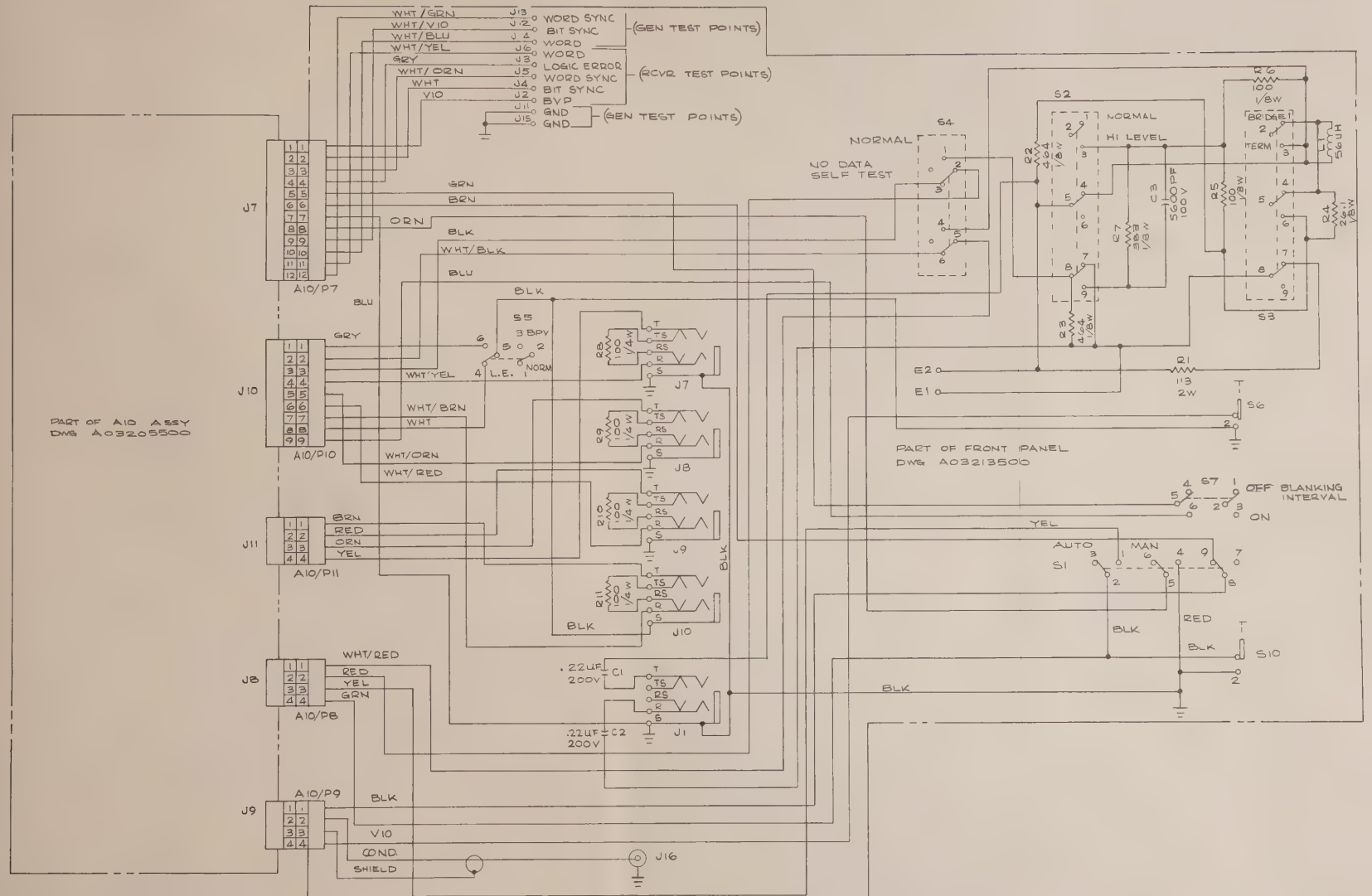


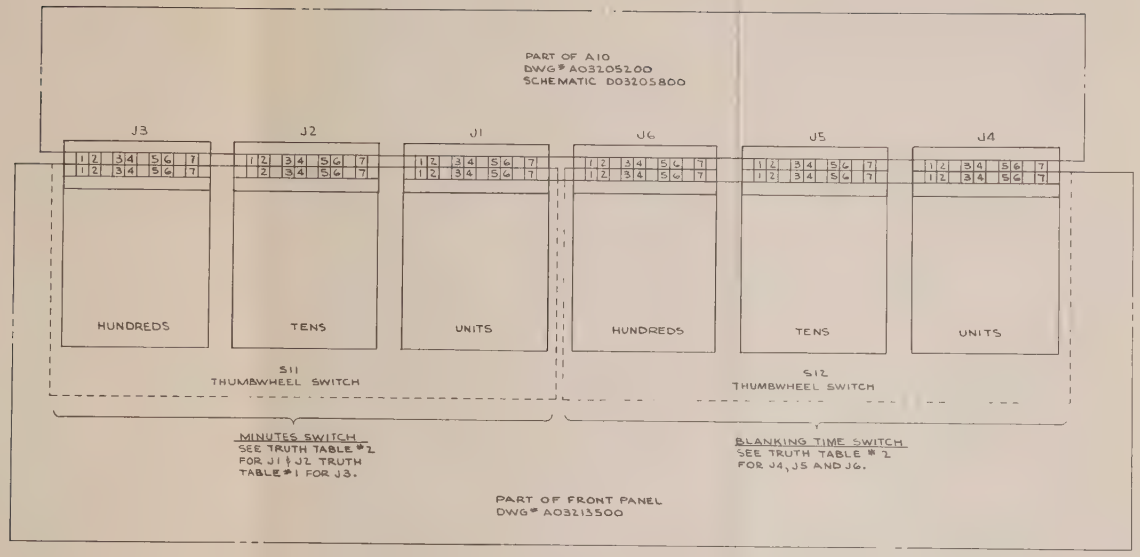
Figure 9-2 (Sheet 2 of 4)
Interconnect Diagram



NOTE: UNLESS OTHERWISE SPECIFIED.
1. ALL RESISTANCE IN OHMS.

D03254400B

Figure 9-2 (Sheet 3 of 4)
Interconnect Diagram



TRUTH TABLE #1
THUMBWHEEL SW MB001

DIAL	A			B	
0	0		COM A	0	COM B
1		0			0
P.C. TERMINATIONS					
	6	5	1	7	3	4

TRUTH TABLE #2
THUMBWHEEL SW MB161

DIAL	1	2	4	8	
0	0	0	0	0	
1		0	0	0	
2	0		0	0	
3			0	0	
4	0	0		0	
5		0		0	
6	0			0	COMMON
7				0	
8	0	0			
9		0			
P.C. TERMINATIONS					
	1	2	7	6	5

Figure 9-2 (Sheet 4 of 4)
Interconnect Diagram

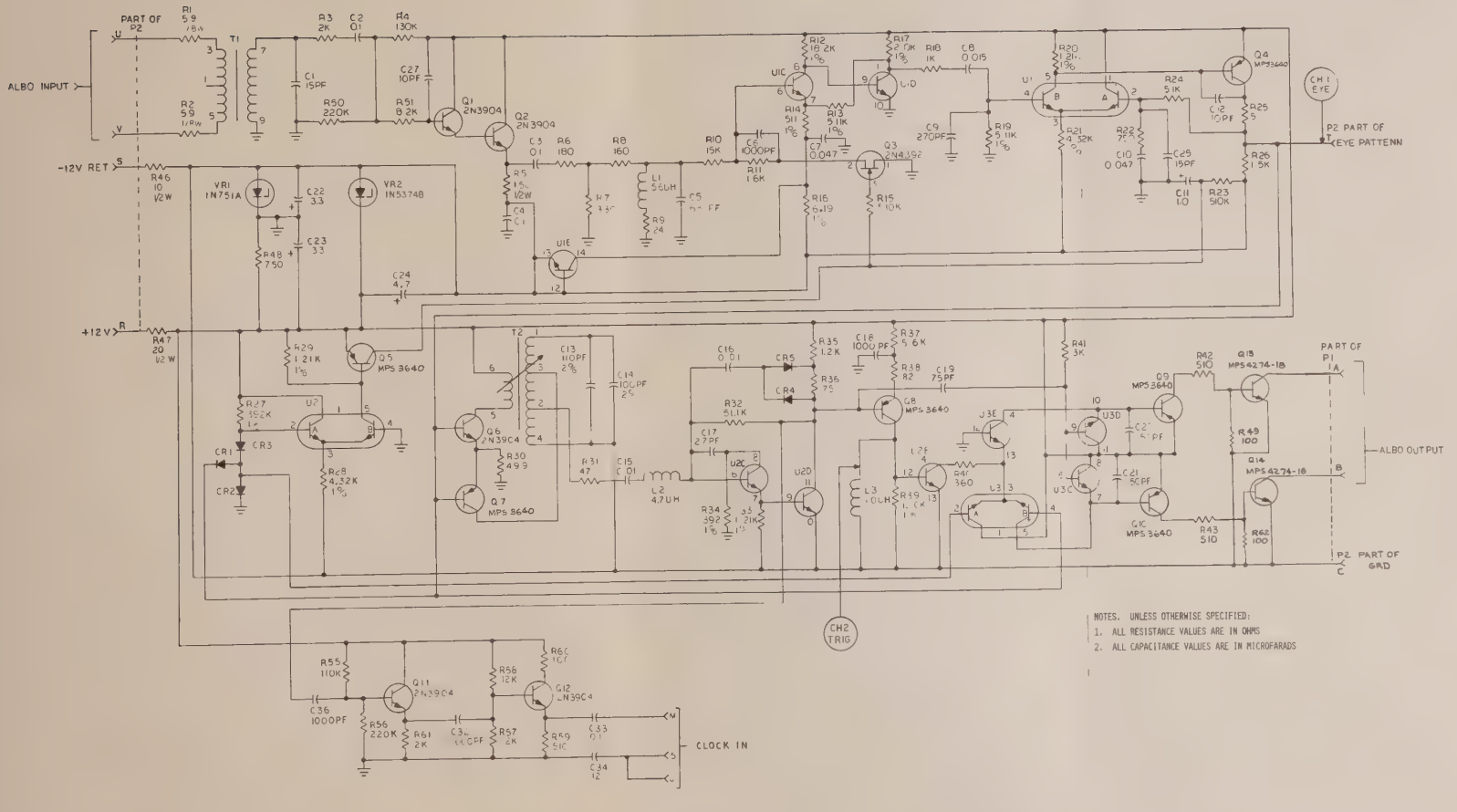


Figure 9-3
Schematic Diagram, A1 ALBO

D03165800G

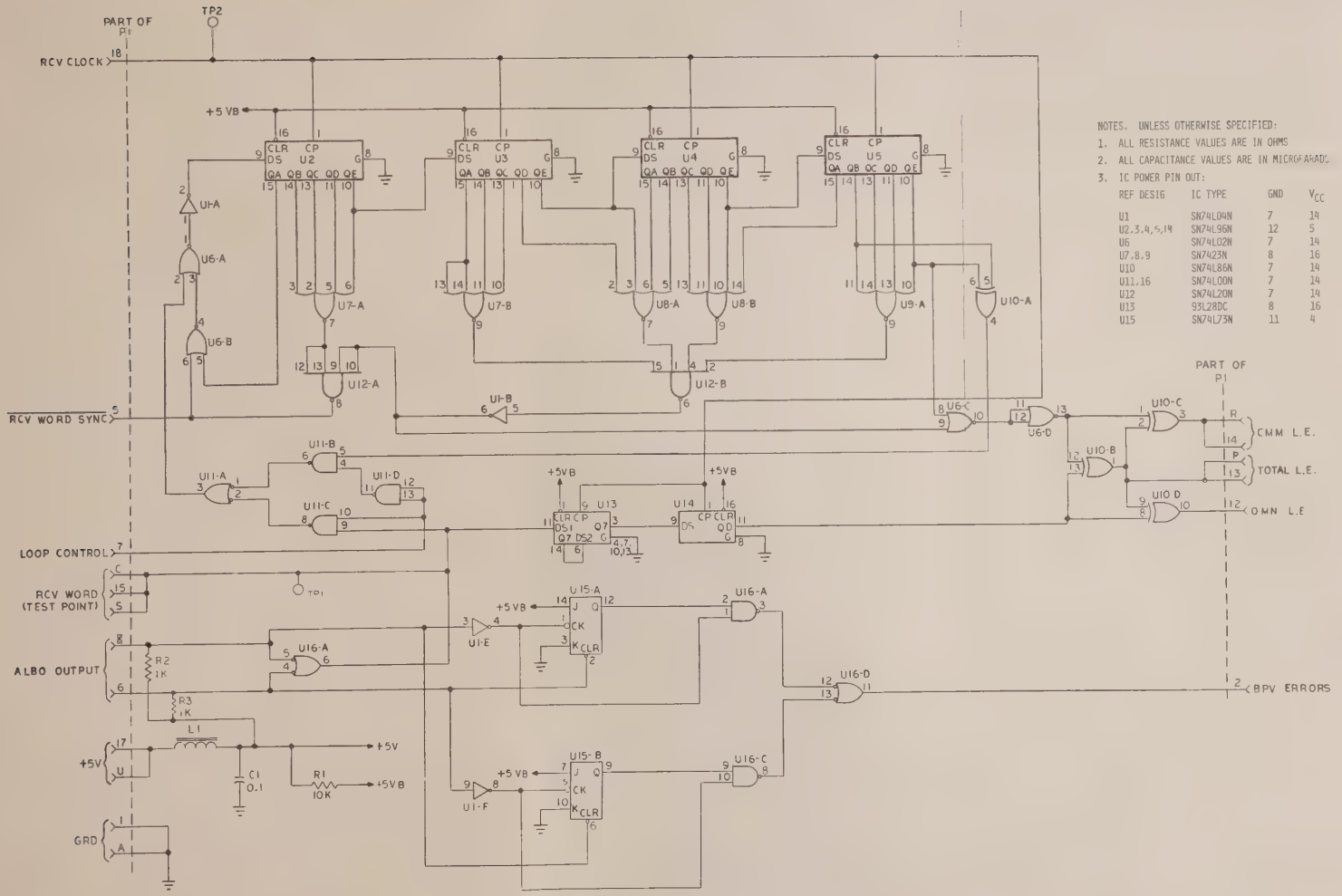
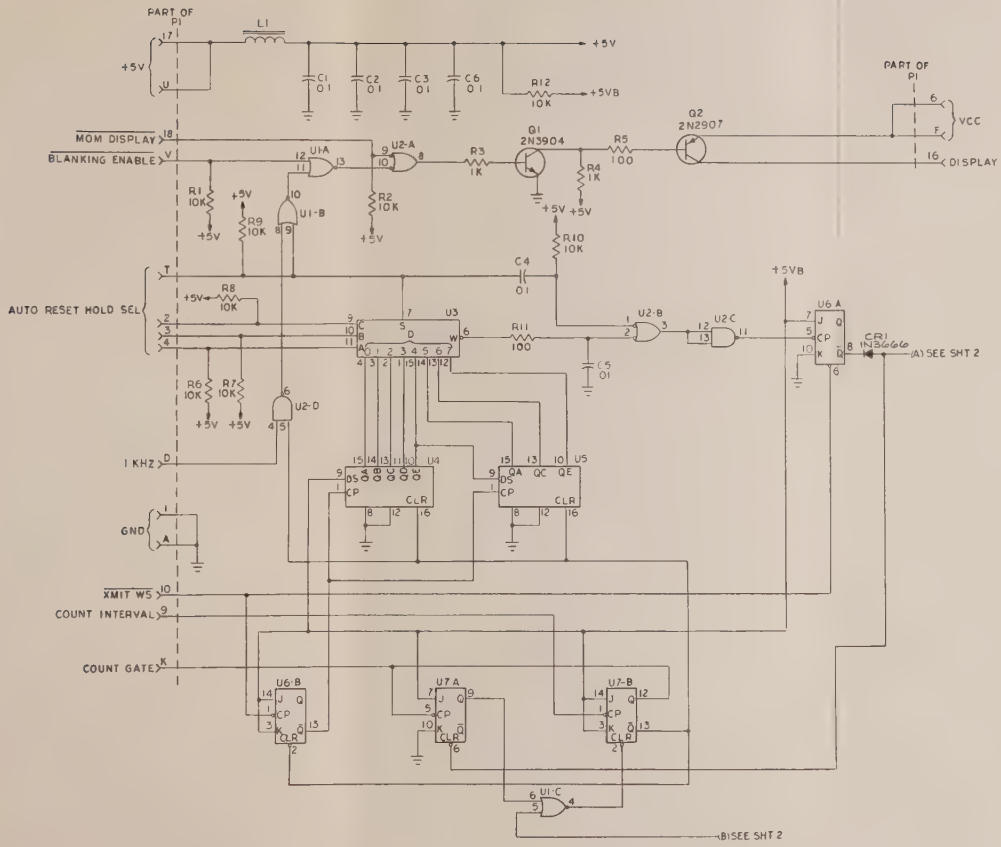


Figure 9-4
Schematic Diagram, A2 Receiver Power Generator



NOTES. UNLESS OTHERWISE SPECIFIED:

1. ALL RESISTANCE VALUES ARE IN OHMS
2. ALL CAPACITANCE VALUES ARE IN MICROFARADS
3. IC POWER PIN OUT:

REF DESIG	IC TYPE	GND	V_{CC}
U1	SN74L02N	7	14
U2,8	SN74L00N	7	14
U3	SN74151N	8	16
U4,5	SN74L96N	12	5
U6,7,18	SN74L73N	11	4
U9,10,11,15, 16,17	SN74L90N	10	5
U12,13,14	SN74L157N	8	16

Figure 9-6 (Sheet 1 of 2)
Schematic Diagram, A4 Error Counter

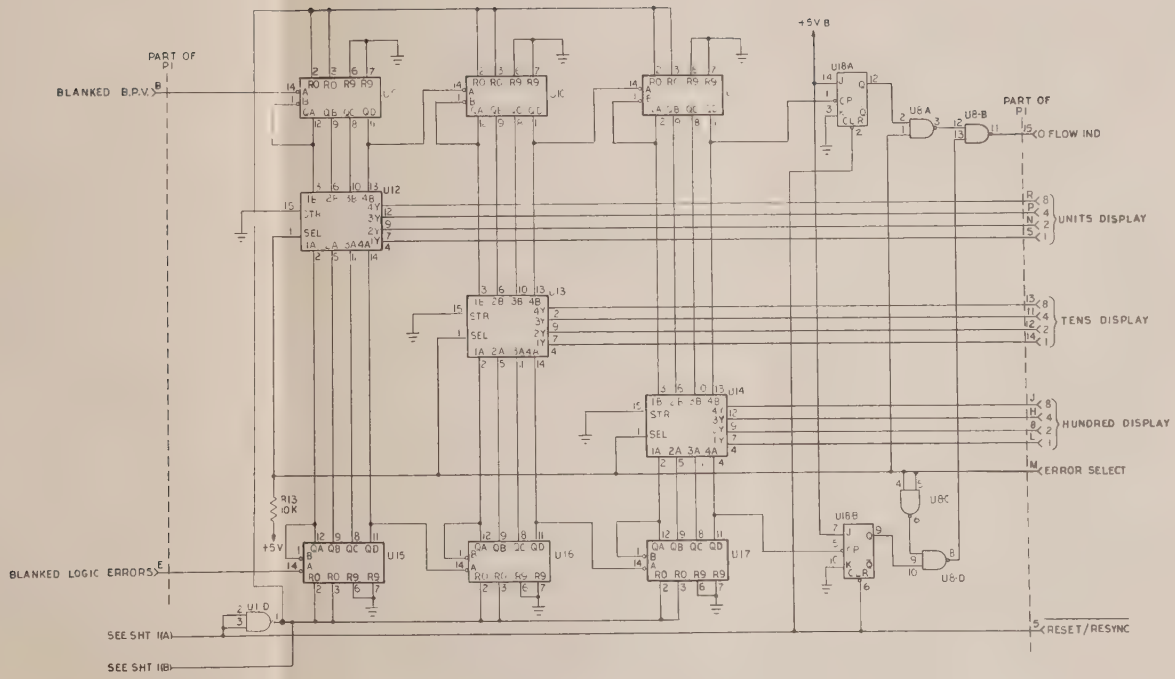
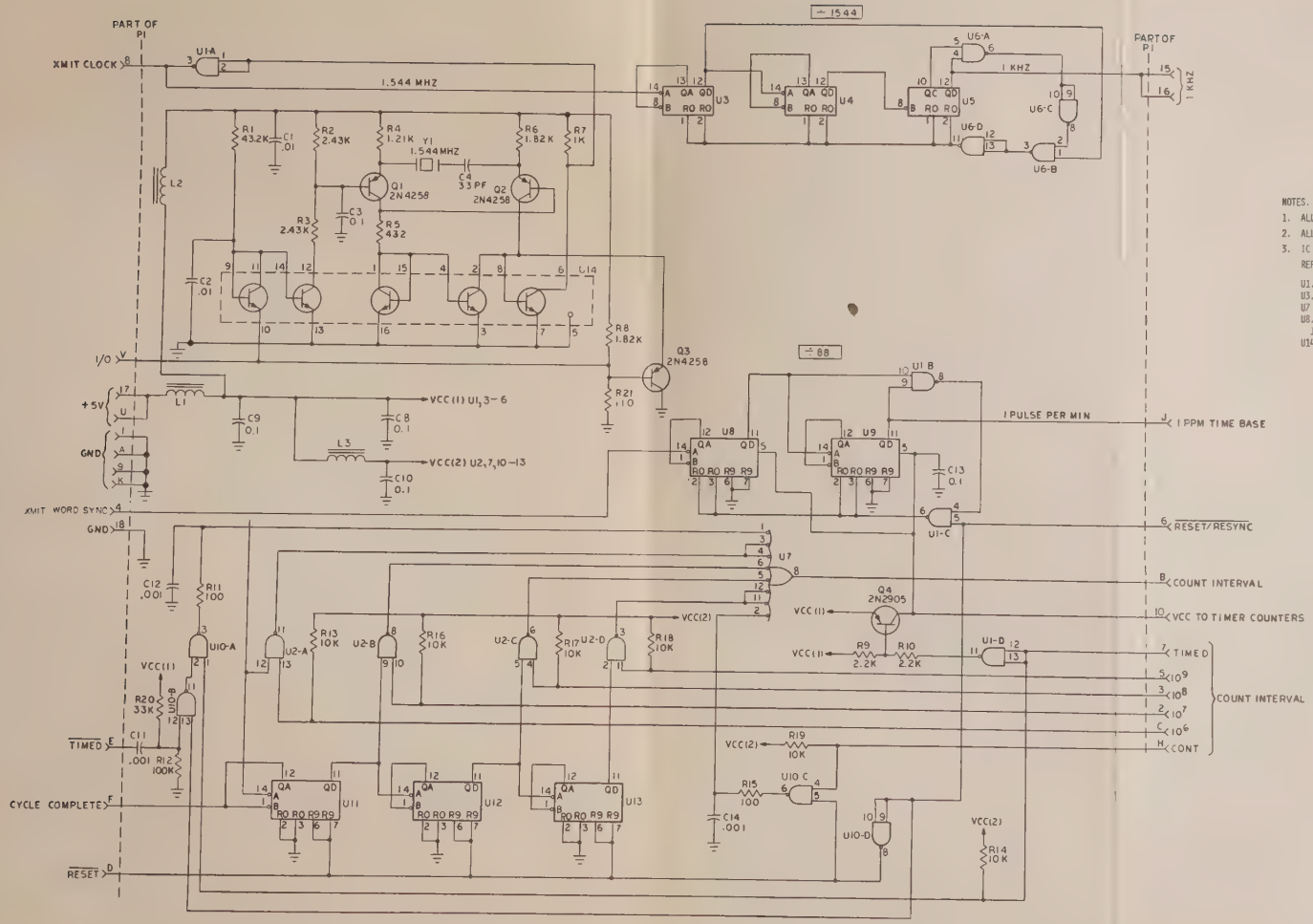


Figure 9-6 (Sheet 2 of 2)
Schematic Diagram, A4 Error Counter



NOTES. UNLESS OTHERWISE SPECIFIED:

1. ALL RESISTANCE VALUES ARE IN OHMS
2. ALL CAPACITANCE VALUES ARE IN MICROFARADS
3. IC POWER PIN OUT:

REF DESIG	IC TYPE	GND	V_{CC}
U1,2,6,10	SN74L00	7	14
U3,4,5	SN74L93	11	4
U7	SN74L30	7	14
U8,9,11,12,13	SN74L90	10	5
U14	CA3127E	5	-

D03166200D

Figure 9-7
Schematic Diagram, A5 Time Base and Divider

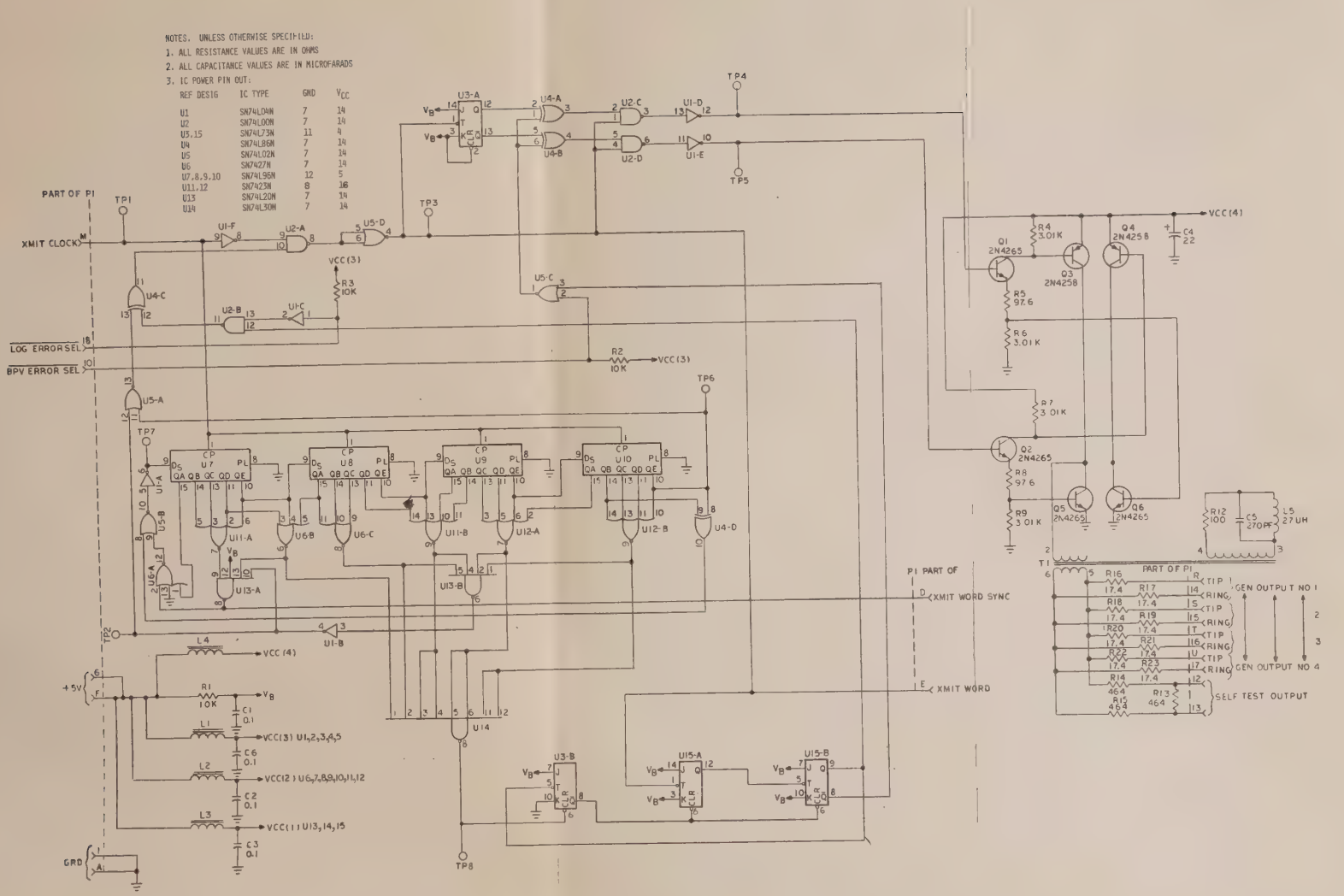
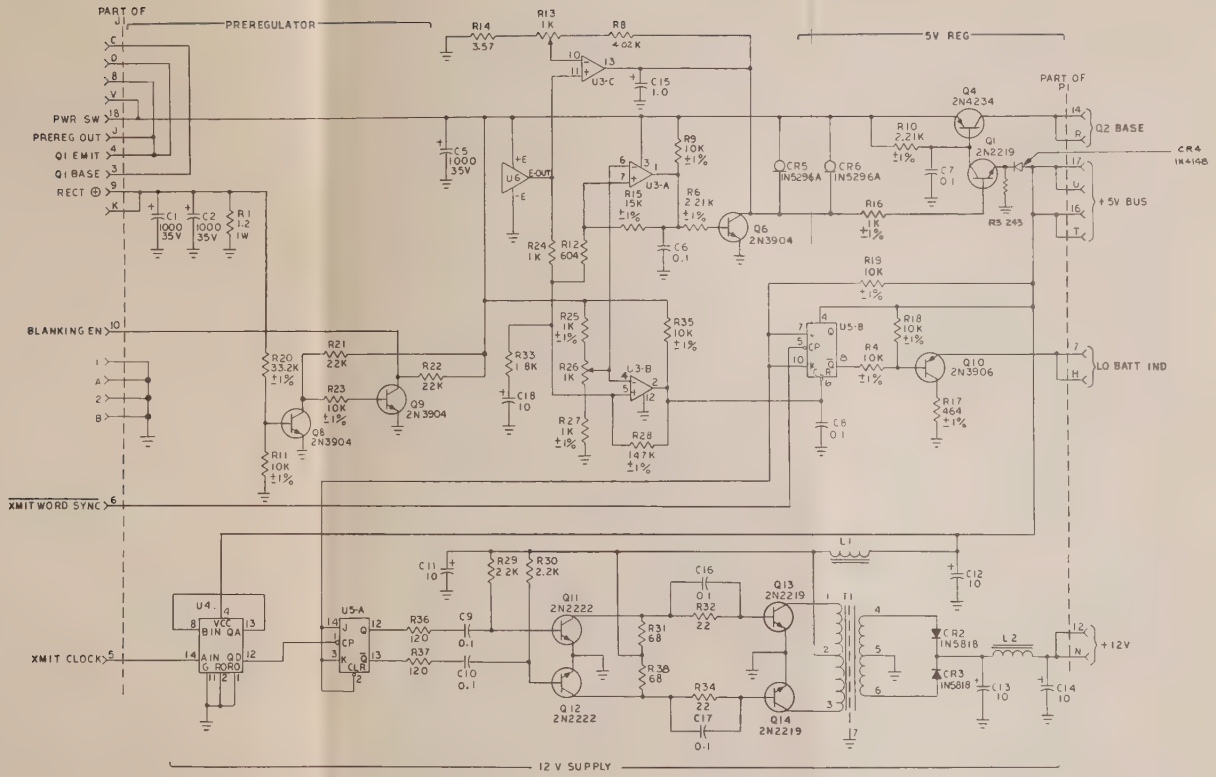


Figure 9-8
Schematic Diagram, A6 Generator

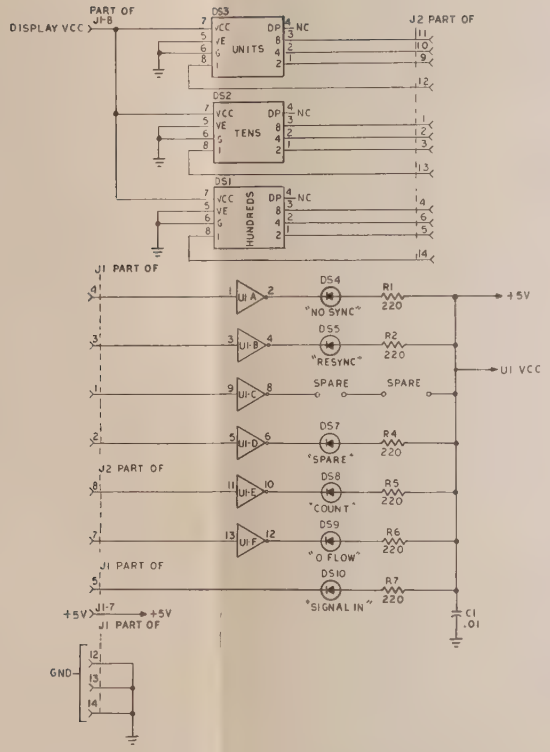


NOTES. UNLESS OTHERWISE SPECIFIED

1. ALL RESISTANCE VALUES ARE IN OHMS
2. ALL CAPACITANCE VALUES ARE IN MICROFARADS
3. IC POWER PIN OUT:

REF DESIG	IC TYPE	GND	V_{CC}
U3	MC3302P	12	3
U4	SN74L93N	11	4
U5	SN74L73N	11	4
U6	AD580K		

Figure 9-9
Schematic Diagram, A7 Power Supply



NOTES. UNLESS OTHERWISE SPECIFIED:
1. ALL RESISTANCE VALUES ARE IN OHMS
2. ALL CAPACITANCE VALUES ARE IN MICROFARADS
3. IC POWER PIN OUT:

REF DESIG	IC TYPE	GND	V_{CC}
U1	SN74LO4N	7	14
DS1.2.3	HP 5082-7300	5,6	7

Figure 9-10
Schematic Diagram, A9 Display

NOTES. UNLESS OTHERWISE SPECIFIED:

1. LOGIC 0 = 0 VOLTS OR CLOSED CIRCUIT TO GROUND
2. LOGIC 1 = +5 VOLTS OR OPEN CIRCUIT
3. FORCED TO A LOGIC 1 STATE FOR ALL POSITIONS OF S2 WHEN THE COUNT INTERVAL SWITCH IS SET TO THE TIMED OR THE CONTINUOUS POSITIONS. OR WHEN THE RESET/RESYNC SWITCH IS SET TO THE MANUAL POSITION
4. THE SELECTED POSITIONS OF THE REMOTE SELECTOR WILL REPEAT THE TRUTH TABLE ENTRIES LISTED ABOVE.
5. ALL RESISTANCE VALUES ARE IN OHMS
6. ALL CAPACITANCE VALUES ARE IN MICROFARADS
7. IC POWER PIN OUT:

REF DESIG	IC TYPE	GND	V_{CC}
U1,2,4-9	74L192N	8	16
U3	74L73N	11	4
U10	74L10N	7	14
U11,12	74L00N	7	14
U13	74L123N	8	16

TRUTH TABLE #3
S2 SWITCH AUTO-RESET HOLD TIME SELECTOR

*HOLD TIME	BINARY WEIGHT 1	2	4	8
1	0	0	0	0
2	1	0	0	0
3	0	1	0	0
4	1	1	0	0
5	0	0	1	0
6	1	0	1	0
7	0	1	1	0
8	1	1	1	0
HOLD	0	0	0	1
MEAS. POINT TO GND	J8-L	J8-11	J8-K	J8-V 3

SEE NOTES 1, 2, AND 3

TRUTH TABLE #4
S3 SWITCH DISPLAY MODE SELECTOR

SWITCH POSITION	REAR DECK DISPLAY MODE SELECT BPV/L.E.	TOTAL	CMN	OMN	FRONT DECK DISPLAY Vcc A9 PWB	REMOTE
BPV	1	1	0	0	Vcc	OFF
TOTAL L.E.	0	1	0	0		
CMN L.E.	0	0	1	0		
OMN L.E.	0	0	0	1		
*REMOTE	REMOTE J16-X (E8) 4	REMOTE J16-Y (E9) 4	REMOTE J16-A (E11) 4	REMOTE J16 Z (E10) 4	OFF	Vcc
MEASUREMENT POINT TO GROUND	J8-P	J8-8	J8-J	J8-H	W1-8 (E59)	REMOTE J16-B (E12)

*OPTIONAL ON S/W's 154 AND UP

SEE NOTES 1, 2, AND 4

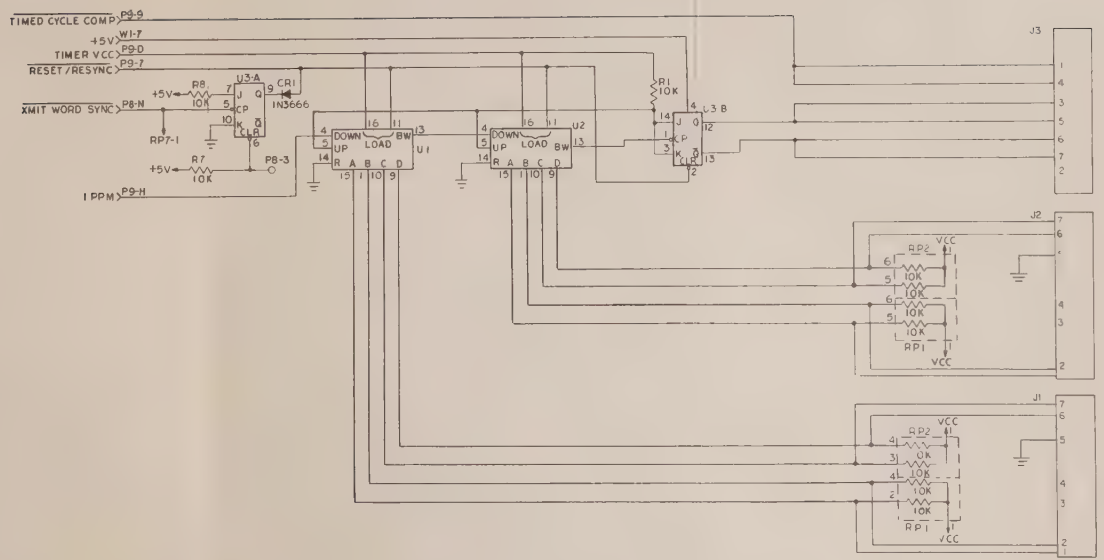


Figure 9-11 (Sheet 1 of 4)
Schematic Diagram, A10/A50 Control

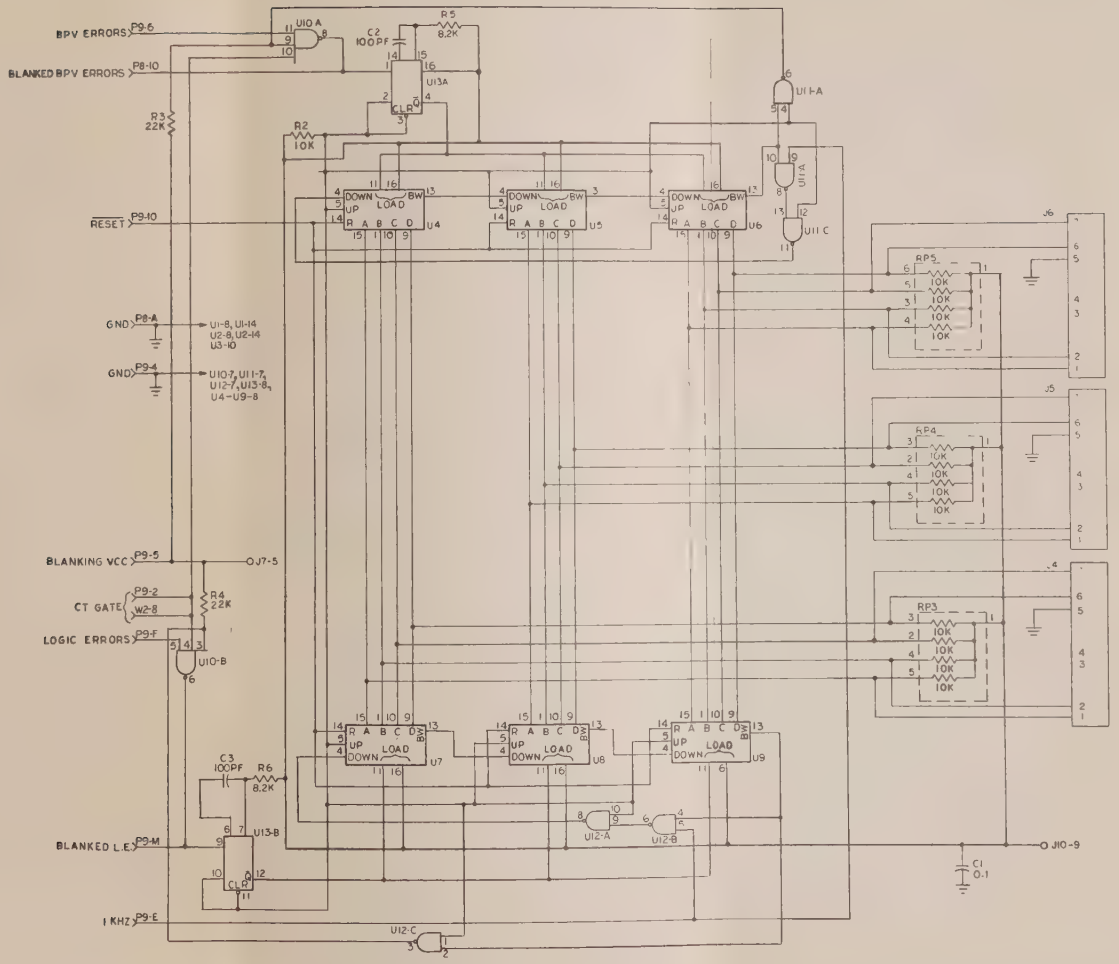


Figure 9-11 (Sheet 2 of 4)
Schematic Diagram, A10/A50 Control

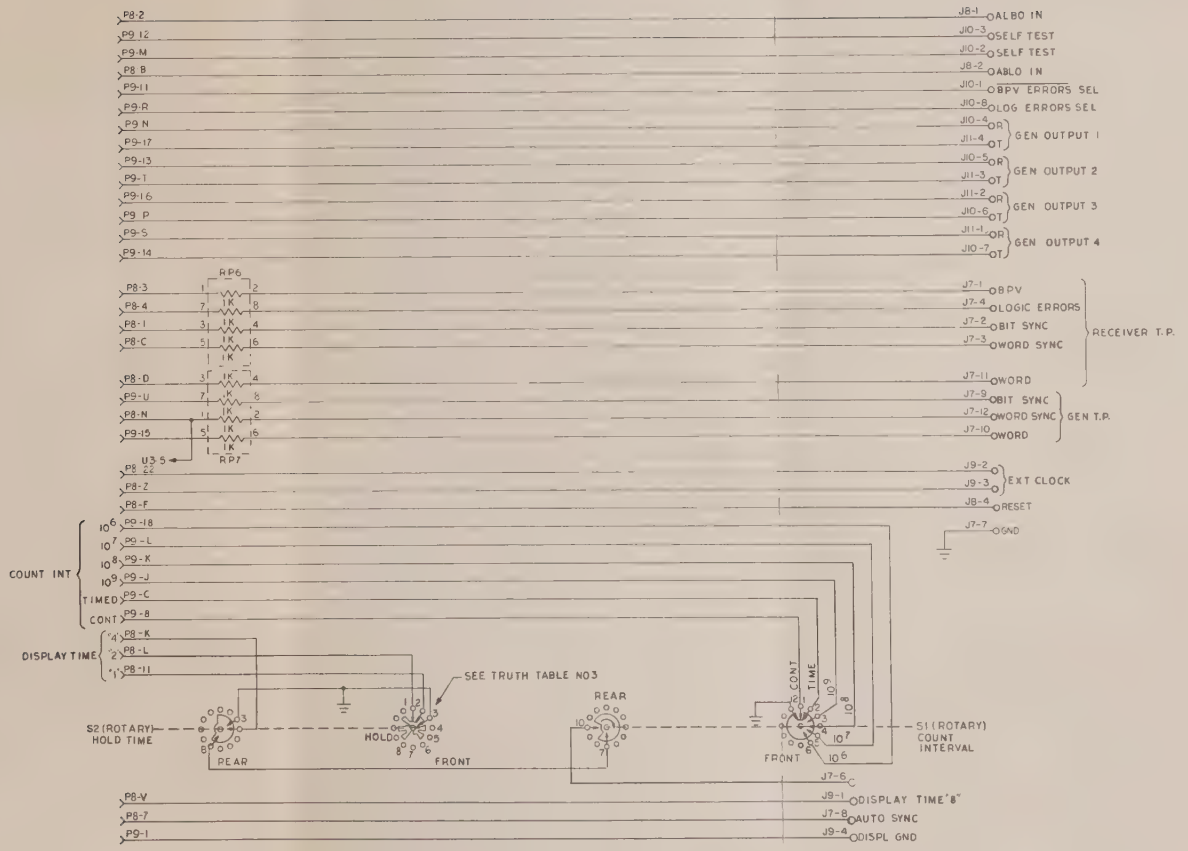


Figure 9-11 (Sheet 3 of 4)
Schematic Diagram, A10/A50 Control

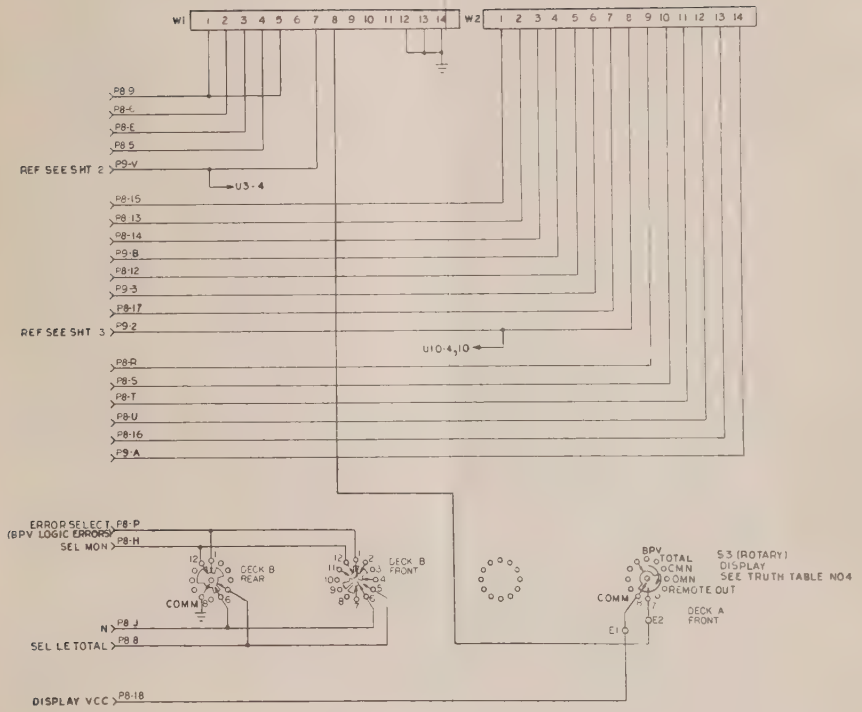


Figure 9-11 (Sheet 4 of 4)
Schematic Diagram, A10/A50 Control

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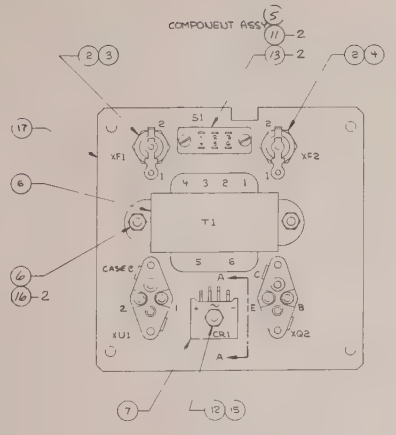
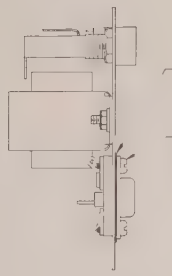
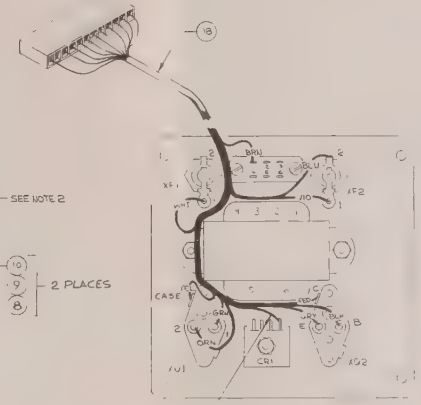
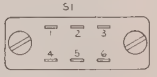
REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED
	3	PILOT RUN RELEASE		
	3a	PCO UPDATE: 273, 308, 383, 563, 590, 591		
	B	PRE-PRODUCTION RELEASE	6/8/76	
	B1	PCO # 16016		
	C	PRODUCTION RELEASE	3/8/77	
	D	ECO # 16619A	3/8/77	
	E	ECO # 16937	6/9/78	

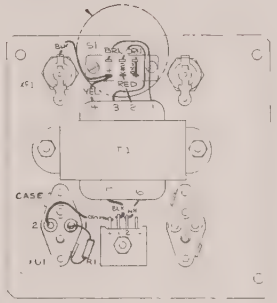








SEE DETAIL A



NOTES:
1. TRIM LEADS OF ITEM 7 (CR1) TO .75 (3/4) AND FORM AS SHOWN IN SECTION A-A, SLEEVE WITH 3/4 INCH OF ITEM 21.
2. APPLY A THIN LAYER OF HEATSINK COMPOUND (IERC THERMATE OR EQUIV) TO BOTH SIDES OF INSULATORS SUPPLIED WITH ITEM 9 (XQ1 & XQ2).

FOR L/M SEE A03213600

QTY	QTY	QTY	QTY	ITEM NO.	PART OR IDENTIFYING NO	DESCRIPTION OR NOMENCLATURE	MATERIAL	SPEC OR NOTE
						LIST OF MATERIAL OR PARTS LIST		

ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A, INTERNAL THREADS TO BE CLASS 2B AFTER PLATING, UNLESS OTHERWISE SPECIFIED

63 FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED. REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED

DO NOT SCALE DWG.

DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED.

TOLERANCE UNLESS SPECIFIED	BASIC	TWO PLACE	THREE PLACE
	UP TO 6	± .02	±
	6 TO 24	± .01	±
	ABOVE 24	± .06	±
	ANGULAR DIMENSION ±		

FINISH: —

Sierra — LEAR SIEGLER, INC. SIERRA ELECTRONIC DIVISION, MENLO PARK, CALIFORNIA 94025

CODE IDENT. NO. 94668

PANEL ASSEMBLY POWER

ASSY OR ITEM	QTY NEXT	NEXT ASSY.	MODEL NO.
00	1	A0323600	4 84-1
		APPLICATION	

DRAWN: PBP 3SEP76
CHECKED: [illegible] 6/9/78
APPR:

SIZE D | DRAWING NO D03092100 | REV E

SCALE FULL | STOCK AS — | SHEET 1 OF 2

D03092100

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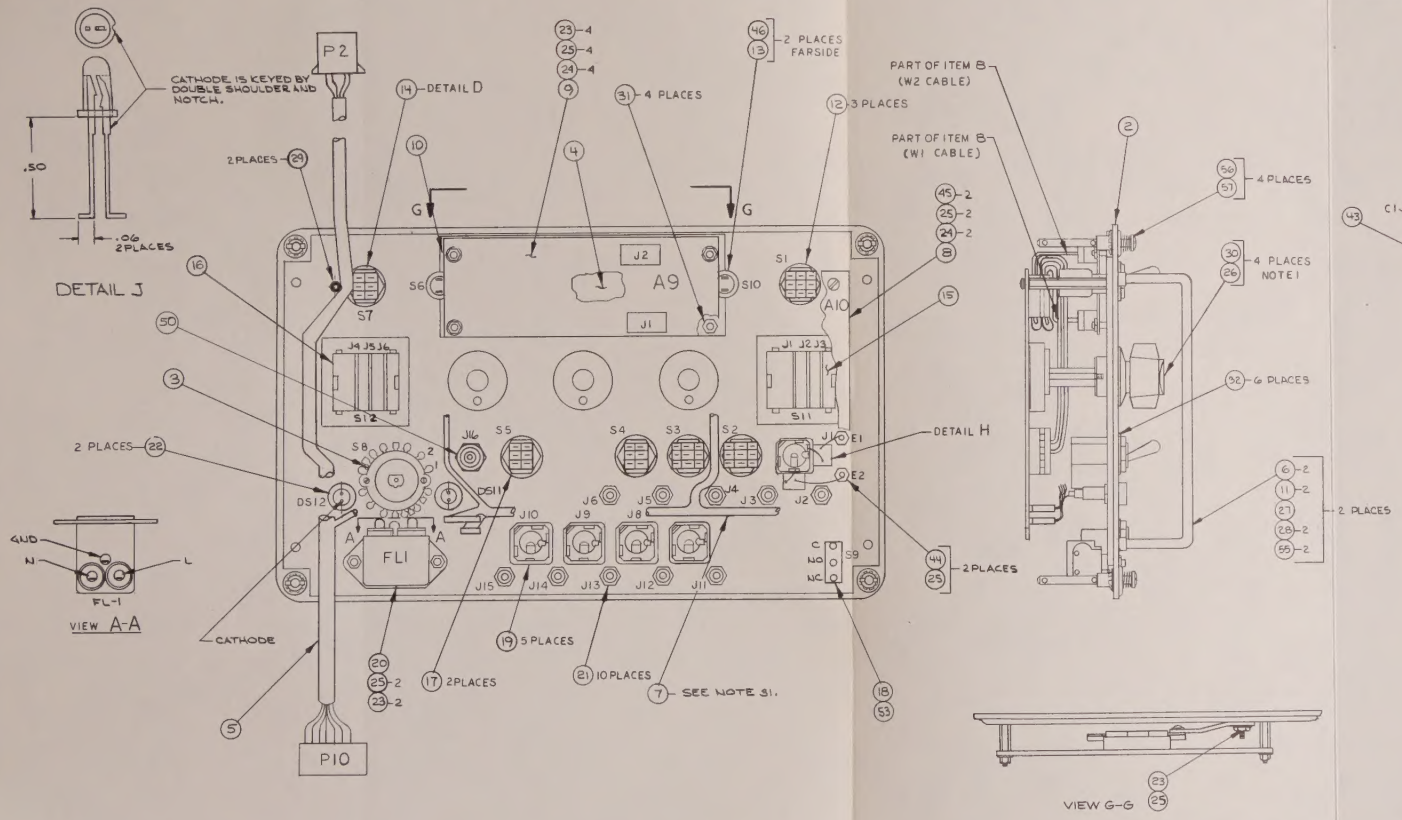
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		SEE SHEET 1		



QTY.	QTY.	QTY.	QTY.	ITEM NO.	PART OR IDENTIFYING NO.	DESCRIPTION OR NOMENCLATURE	MATERIAL OR NOTE	SPEC	CODE IDENT.
						LIST OF MATERIAL OR PARTS LIST			

ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A, INTERNAL THREADS TO BE CLASS 2B, AFTER PLATING UNLESS OTHERWISE SPECIFIED

FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED. REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED.

DO NOT SCALE DWG.

DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED.

TOLERANCE UNLESS SPECIFIED		
BASIC	TWO PLACE	THREE PLACE
UP TO 6	± .02	± .005
6 TO 24	± .03	± .010
ABOVE 24	± .06	± .015
ANGULAR DIMENSION	± 1/2°	

Sierra — CODE IDENT. NO. 54778

LEAR SIEGLER, INC. SIERRA ELECTRONIC DIVISION, MENLO PARK, CALIFORNIA 94025

PANEL ASSEMBLY, FRONT

ASSY. OR ITEM	QTY. NEXT	NEXT ASSY.	MODEL NO.
		SEE SHT 1	
		APPLICATION	

DRAWN 5-8-76 CHECKED APPROVED

SIZE D | DRAWING NO. D03205100 | REV. F

SCALE 1/1 | STOCK AS | SHEET 2 OF 5

D03205100

LEAR SIEGLER, INC.
SIERRA ELECTRONIC DIVISION
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Tel. (415) 321-5374 TWX 910-373-1282